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# MONOGRAPH

OF THE

# COCCIDÆ OF THE BRITISH ISLES.

BY

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TO THE OFFICERS AND COMMITTEE

OF THE

CHESTER SOCIETY OF NATURAL SCIENCE,
LITERATURE, AND ART

(FOUNDED BY CHARLES KINGSLEY),

THIS VOLUME IS,

WITH KIND PERMISSION, DEDICATED

AS A TOKEN OF GRATITUDE AND SINCERE RESPECT,

BY THEIR OBLIGED AND FAITHFUL SERVANT

THE AUTHOR.

# PREFACE.

The issue of this volume completes the monograph of the Coccidæ of the British Isles. As my investigations have extended over a period of nearly fourteen years it may reasonably be assumed that the work is thoroughly representative of the coccid fauna of this country; but owing to the rapid means of transit it is highly probable that aliens may from time to time arrive here on freshly-imported plants.

The introductory chapters given in vol. i on the life-history and metamorphoses of the Coccidæ have been largely supplemented in this volume by many new and interesting observations; the most noteworthy will be found at pp. 58–66, 130, 135, 180, 218–220.

The number of species found within the British Isles is eighty-eight, with four varieties; of this total, fifty-one species and two varieties have been found living under glass, and have undoubtedly been introduced from other countries. A few of these aliens have, apparently, existed in this country as plant pests for more than half a century; while others have been introduced within the last fifteen years, and, with the exception of a few species, have apparently come to stay and add to the difficulties of plant-culture.

During the progress of the publication of this work several important changes in the nomenclature of the Coccidæ have been suggested by other students of the group, which if adopted will involve a remarkable interchange of several long-established generic names. Thus, in order to accord with the laws of priority, it

has been proposed that the species hitherto included in the genus *Lecanium* should be referred to *Coccus; Coccus* to *Dactylopius; Dactylopius* to *Pseudococcus; Pseudococcus* to *Phenacoccus;* and *Apterococcus* to *Fonscolombia.* All these alterations have been dealt with in the Appendix, to which I must refer the student for further particulars.

It was originally intended to give a full bibliography of the Coccidæ, but, owing to the great number of separate papers which have appeared in various journals and other publications, it has been decided to abandon the list. The student will, however, find the references to all the important works and papers which have been consulted given in connection with the various genera and species which have been dealt with throughout the work.

Having completed my task, the very pleasant duty devolves upon me of again tendering my most sincere thanks to the Council of the Ray Society for their kindness and generosity in undertaking the publication of this costly monograph.

I beg also to acknowledge a further grant of £20 from the Royal Society, which has enabled me to make extended journeys into various parts of the country, thereby adding materially to our knowledge of the distribution of the indigenous Coccidæ.

My special thanks are due to the Secretary of the Ray Society, Mr. John Hopkinson, F.L.S., who has undertaken the task of reading through my MSS. and proofs, and has made suggestions which have proved most valuable. I have also to thank Mr. R. McLachlan, F.R.S., for looking through the final proofs.

R. N.

The Grosvenor Museum,
Chester;
*May* 30*th*, 1903.

# THE COCCIDÆ OF THE BRITISH ISLES.

## Conchaspinæ.

This sub-family is represented by the single genus *Conchaspis*, of which only three species are at present known. The insects comprising this aberrant genus are chiefly characterised by both sexes forming a separate covering-scale or puparium, as in the Diaspinæ, differing, however, in having no exuviæ or cast skins incorporated with the secretionary matter. The adult female retains both limbs and antennæ, and has a biarticulate mentum; and the tibio-tarsal joints in both sexes are united. In his 'Coccidæ of Ceylon,' p. 20, Mr. Green suggests that the two-jointed mentum in the adult female points to some affinity with the Coccinæ. I feel, however, that the Conchaspinæ are more nearly related to the Diaspinæ than to any other division of the Coccidæ.

### Conchaspis (Cockerell).

### Pseudinglisia (Newstead).

This genus was established by Mr. Cockerell, but his description * amounted to little more than a name. In founding the genus *Pseudinglisia* five months later, I gave the following diagnosis:

"Scale elevated, more or less circular, ridged; ventral scale complete, detached; antennæ of four joints; anal lobes very minute; last five segments of body with broad chitinous plates bearing spinnerets; ros-

* "Coccidæ or Scale Insects," 'Bull. Bot. Dept. Jamaica,' February, 1893, p. 9.

trum biarticulate."* Mr. Green† rightly considered this to be too narrow to admit a congeneric insect from Ceylon, and he suggested the following temporary diagnosis :

"Scale elevated, more or less circular; adult female retaining limbs and antennæ, the latter of few joints; genital aperture without setiferous ring; mentum biarticulate; terminal segments of body united into a piece somewhat resembling the pygidium of the *Diaspinæ*."

In the Ceylonese *C. socialis*, Green, and also in *C. angræci*, Ckll., there is no true tibio-tarsal articulation, but merely an indentation of the integument (Pl. XXXV, fig. 8), and both species also possess three pairs of ventral spiracles. In my original diagnosis of *C. rodrigueziæ* I described the tibiæ as "grooved and about as long again as the tarsi." But having now made more careful preparations of the insects, I am confident that there is no true tibio-tarsal articulation.

The only male of this genus known is that of *C. socialis*, which Mr. Green (l. c.) describes as "not unlike the males of *Planchonia*. . . . Ocelli four, rather small. Antennæ with seven joints. . . . Wings long and ample. Genital spike very long and slender. . . . Tibio-tarsus long and slender, without any trace of division." The male puparium he describes as "white, oblong, flattened, closely felted, completely enveloping the pupa. The hinder extremity has a valvular opening. . . . The male puparia do not occur separately, but are always collected together, in groups of ten or more, beneath the parent scales, which they completely fill." I have found no male puparia under the female scales of *C. angræci;* neither, I believe, has Mr. Cockerell, as he makes no reference to such in his description of the puparium of *C. Newsteadi*. The larva of *C. angræci* closely resembles the adult female, but differs in possessing six joints to the antennæ.

* "Notes on New or Little-known Coccidæ," 'Ent. Mo. Mag.,' s.s., vol. iv, July, 1893, p. 153.

† 'Coccidæ of Ceylon,' p. 14.

## Conchaspis angræci (Cockerell).

(Pl. XXXV, figs. 1–10.)

*Conchaspis angræci*, Cockerell; "Coccidæ or Scale Insects," Bulletin Bot. Dept. Jamaica, Feb., 1893, p. 9.

*Pseudinglisia rodrigueziæ*, Newstead; Ent. Mo. Mag., s.s., vol. iv, p. 153, pl. ii, figs. 1, 1 *a*–1 *h*, 2, 2 *a*, 3, 3 *a*–3 *c*, July, 1893.

Puparium of adult female (figs. 1–3) approximately circular, somewhat conical, apex bluntly pointed, margins broad and flat; radiating from the apex are from six to eight strong ridges or carinæ, many of which disappear before reaching the centre between the apex and margin. White, sub-opaque, the spaces between the carinæ and sometimes irregular bands beyond them, darker, and of a more glass-like texture. Ventral scale free, complete; white, with sometimes a central yellowish stain.

Wide, 2–2·25 mm.; high, ·50–1 mm.

Adult female (fig. 4) dark purplish-red, mottled with lighter red; elongate-ovate, widely rounded in front, gradually narrowed behind from the insertion of the posterior pair of legs; segmentation very distinct in the living insect; margins of the segments at the sides and the cephalic margin with groups of slender hairs, which gradually lengthen towards the anterior extremity. Eyes large, tuberculate, projecting from the margin, and concolorous with the body. Antennæ (fig. 7) of four nearly equal joints, formula usually 2, 3, 4, 1, but there is an amount of variation, and young adults sometimes possess antennæ of both four and five joints; apical joint usually with three short, slender, spine-like hairs, and the first and second joint with two or more very slender ones. Mentum bi-articulate, apex furnished with hairs; base of mentum unusually broad. Legs (fig. 8) rather short and

inserted near the margin; tibio-tarsal joint obsolete, but there is a constriction on the upper side towards the claw, the latter being toothed on the inner margin towards the base, from which arises a very minute hair; the tarsal digitules are represented by a slender hair; and there are a few similar hairs on the coxæ. Spiracles in three pairs, one immediately below the insertion of each leg; externally they are almost circular, with a crescent-shaped slit or opening. Last five segments forming a pygidium (fig. 5), somewhat resembling the pygidia in the *Diaspinæ*, but each segment is represented by a broad chitinous plate, four of which are bluntly pointed, and terminate at or near the centrally-placed vaginal opening; each plate bears two or three large circular spinnerets. Terminal segment (fig. 6) with a broad, terminal, highly chitinised, projecting process, centrally extended into the form of a pair of flat, lobe-like processes, immediately anterior to which is a short spine; there is also another similar spine towards the centre, and a much longer one towards the termination of the process. Immediately anterior to the central lobes is a minute spine-bearing lobe resembling those in the *Dactylopiinæ*.

Long, 1 mm.

Larva resembling the female, but short and ovate, and the antennæ (fig. 10) are six-jointed, of which the last two are the longest; the fifth bears one rather long hair, and the sixth two or three. Formula 5, 6, 1 (2, 3, 4). Legs with the tibio-tarsal joint (fig. 9) obsolete as in the adult female; digitules to claw and tarsi simple. Rostrum biarticulate and very broad at the base. Terminal segments with chitinous plates.

*Habitat.*—On freshly-imported plants of *Rodriguezia secunda* from Trinidad, at Eaton Hall, Chester, the seat of His Grace the Duke of Westminster. The first batch of insects was sent to me on a leaf of the food-plant by the late Mr. Charles Hand, the orchid grower, in December, 1889. In the following January I obtained a second supply from the same source,

which fortunately had escaped the severe cleaning the plants had undergone. No further trace of the insect has been seen, so that it has undoubtedly been exterminated.

*Distribution.*—Known only out of England in the West Indies—Trinidad, Jamaica (Cockerell), Barbados (Maxwell Lefroy). The var. *hibisci*, Ckll., was found by Mr. Townsend on *Hibiscus*, at Tampico, Mexico.

*C. Newsteadi*, Ckll., is described from Vera Cruz, Mexico.

## Explanation of the Plate.

Pl. XXXV, fig. 1.—Insects natural size *in situ* on portion of a leaf of the food-plant.

Fig. 2.—Group of four puparia of adult female in various stages (dorsal). × 25.

Fig. 3.—Puparium of adult female (profile). × 40.

Fig. 4.—Adult female after treatment with potash (ventral). × 40.

Fig. 5.—Pygidium of adult female. × 250.

Fig. 6.—Terminal portion of pygidium of adult female. × 600.

Fig. 7.—Antenna of adult female. × *circa* 250.

Fig. 8.—Leg of the adult female. × *circa* 250.

Fig. 9.—Tibio-tarsal joint of larva. × *circa* 250.

Fig. 10.—Antenna of larva. × *circa* 250.

## Lecaniinæ.

Adult females either naked or covered with secretion forming a test or ovisac. Abdomen in all stages with a more or less defined cleft, and on the dorsal surface at the base of the cleft are two more or less triangular lobes or plates. Legs and antennæ generally retained, but a few forms are apodous, and have rudimentary antennæ. Mentum generally monomerous or dimerous. Males generally possessing wings, either

with or without caudal filaments. Genital armature usually with an outer, straight, styliform sheath, but there are important exceptions, notably in *Ceroplastes*.* The puparium of the male is generally of a glassy nature, but in *Aclerda* it is felted.

Larva with large setiferous anal lobes placed *within* the posterior anal cleft.

### Female Ovisac.

In the genera *Aclerda*, *Eriopeltis*, *Signoretia*, and *Lichtensia* the female forms a more or less complete ovisac (Pl. XXXVI, fig. 1*aa*; Pl. XXXVIII, figs. 1–1*b*; Pl. XL, fig. 1; and Pl. XLI, fig. 1), which is secreted from numerous spinnerets and hollow spines (Pl. XXXVIII, figs. 2, 4, 5) variously disposed in the different genera. Exceptionally, as in *Lecanopsis brevicornis*, Newst., the female covers her body with a talc-like or glassy secretion, and a similar kind of secretion is produced by the monotypic genus *Vinsonia* (Pl. XLIII, figs. 2, 3, 11), which assumes the remarkable form of a seven-rayed star.

With *Pulvinaria* (Pl. XLV, fig. 1) the female remains naked throughout life, but secretes an ovisac in the form of a pad or cushion beneath the posterior part of her body. In *P. camellicola* (Pl. XLVIII, figs. 1, 2) the ovisac is many times longer than the body of the insect, but such forms are exceptional. *Ceroplastes* (Pl. XLII, figs. 1–1*c*, 11), one of the most beautiful members of this division, covers her body with variously-shaped, testudiform plates of wax, often delicately tinted with pink or crimson.

The females of the typical genus *Lecanium* are naked in all stages, and the body, whether flat as in *L. hesperidum* (Pl. L, figs. 2–5, 10), or hemispherical as in *L. hemisphæricum* (Pl. LVI, fig. 1), forms a covering for the ova and the young larvæ.

* *Ceroplastes ceriferus*, Ander.; Newstead, 'Indian Museum Notes,' vol. iii (5), p. 21, pl. ii, fig. 1 *m*, 1894.

## Female.

The form of the adult insects comprising this extensive sub-family varies considerably; and their habits are also very dissimilar. In *Aclerda* the adult female (Pl. XXXVI, fig. 5) is apodous, and the antennæ are mere rudimentary stumps. *Physokermes* (Pl. LVIII, figs. 3–5) is also another aberrant genus of this division of the Coccidæ. In its larval stage it exactly resembles a *Lecanium* or a *Pulvinaria;* but the adult insect loses all trace of antennæ and legs, the body becomes intussuscepted, and two large internal chambers or pouches are formed for the reception of

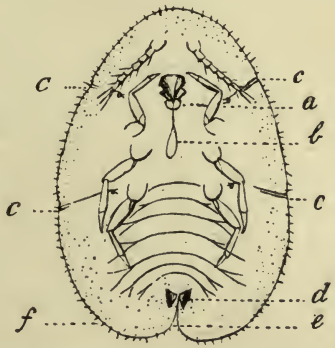



Fig. 1.—Adult female *Lecanium* after treatment with potash, × 20: *a*, mentum; *b*, rostral filaments forming the sucking-tube; *cccc*, ventral channel leading to spiracles; *d*, anal plates or lobes (dorsal); *e*, anal cleft; *f*, marginal spines.

the ova. The anal lobes also take the form of large rounded cornicles. In all the remaining genera found within the British Isles the antennæ and legs are well developed—a fact all the more remarkable as very few species possess the power of progression after the final moult has been effected. The mentum (fig. 1 *a* in text) is short and generally monomerous, and the loop-like filaments forming the sucking-tube (fig. 1 *b* in text) are either moderately long, or extremely short as in

*Signoretia luzulæ*, L. Duf. Two pairs of spiracles are situate on the ventral surface, and a deep semi-cylindrical channel (fig. 1 *cccc* in text) extends from them to the outer margin, where there is usually a group of secreting spines, varying from three, as in *Lecanium*, to an extensive group, as in various species of *Ceroplastes*. The characteristic anal plates (fig. 1*d* in text) are actually flattened lobes; these organs are highly chitinised, and many, if not all the species, have the power of slightly elevating them to allow of the free passage of the anal ring or orifice, which in most cases, if not all, is a retractile organ, highly developed in such species as *Vinsonia stellifera*, Westwood (Pl. LIII, fig. 10, extended), and *Lecanium perforatum*, Newst. (Pl. LV, fig. 10, retracted).

## Male.

The males of *Lichtensia* (Pl. XLI, fig. 7), *Pulvinaria* (Pl. XLVII, fig. 7), and *Lecanium* (Pl. LII, fig. 10, *et seq.*), are characterised by the long white caudal filaments; while the males of *Aclerda Berlesii*, Buffa, *Signoretia luzulæ*, Sign. (Pl. XL, fig. 8), and *Vinsonia stellifera* (Pl. XLIV, fig. 1), like the males of the Diaspinæ, are without these appendages.

In *Ceroplastes ceriferus* (l. c.), the only species in the genus of which the male is known, the genital armature has a broad scoop-shaped outer sheath; while the genitalia in the remaining genera have a long straight sheath, very similar to those of the Diaspinæ.

The number and position of ocelli in the genera *Lichtensia* (Pl. XLI, figs. 8, 9), *Vinsonia* (Pl. XLIV, figs. 5, 6), and *Pulvinaria* (Pl. XLVII, fig. 7*a*) are very dissimilar, and might well be considered of generic importance; but our knowledge of these organs is so incomplete that it would, I think, be unwise at the present moment to consider them of importance in the classification of these insects.

According to M. Moniez, the male of *Lecanium*

*hesperidum* is found in an imperfect condition in an ovarian *cul-de-sac within the body of the parent*, which, correct, would certainly be one of the most remarkable revelations of modern science. I have fortunately been able to discover for the first time the true male puparium* of this common species, which proves beyond all doubt that it, like other members of the genus, undergoes a complete metamorphosis.

### Larva.

(Pl. XXXVIII, fig. 8; Pl. XLIX, fig. 8.)

The larva of both sexes is characterised by the possession of a pair of comparatively large anal lobes within the deep anal cleft, and by the possession also of a monomerous mentum. The legs are usually very long; and the insects are very active during the early days of their life.

### Synopsis of Genera.

*Insects Terrestrial.*

**A.** Females either naked or covered with a glassy or talc-like secretion, or cottony ovisac. Legs and antennæ usually atrophied.
(I) . . . Lecanopsis (2).

*Insects Arboreal.*

**A.** Females covering themselves with a felted ovisac.
*a*. Female apodous and with rudimentary antennæ.
(I) . . . Aclerda (1).
*b*. Female antennæ and legs atrophied.
(II) . . . Eriopeltis (3).

* For further particulars see the description of the species.

*c.* Female antennæ and legs well developed.
*cc.* Female very elongate.
(III) . . . SIGNORETIA (4).
*ccc.* Female not very elongate.
(IV) . . . LICHTENSIA (5).

**B.** Females covering themselves with a glassy secretion.
*a.* Secretionary covering extending considerably beyond the body of the female in the form of a seven-rayed star.
(V) . . . VINSONIA (7).

**C.** Females covering themselves with testudiform plates of wax.
(VI) . . . CEROPLASTES (6).

**D.** Females naked. Ovisac *behind* and partly *beneath* the posterior extremity of the body.
(VII) . . . PULVINARIA (8).

**E.** Females naked. No ovisac.
*a.* Females retaining legs and antennæ. Old adults hollow beneath.
(VIII) . . . LECANIUM (9).
*b.* Female without antennæ and legs; body with two internal ovarian pouches.
(IX) . . . PHYSOKERMES (10).

## GENUS ACLERDA (Signoret).

The diagnostic characters of this genus are derived chiefly from the larvæ, as the adult females are excessively degenerate and offer few differential characters. The genus was established by Signoret to include his *Aclerda subterranea*, in which the adult female is characterised by the entire absence of antennæ and legs. As its name implies, it is a subterranean species, and is found in Southern France and Italy. *A. Berlesii*, Buffa, is the only other known European species. It attains a length of 9 mm., and is very abundant on *Arundo donax* in Italy. Mr. Cockerell informs me that his *Sphærococcus* (*Pseudolecanium*)

*tokionis* is, as Mr. Green has recently discovered, also an *Aclerda*, and was originally found on a species of bamboo in the vicinity of Tokio, Japan. Whether the remaining species in this division can here be placed without materially widening the bounds as set forth by Signoret, I must leave with those students in whose hands the more recent material is placed.

The puparium of the male of *A. Berlesii* is a felted sac open at the posterior extremity. The perfect male has a short genital armature, and there are no caudal filaments.

All the known larvæ are remarkable for their excessively elongate form. The margins of the body are furnished with a regular series of short, blunt hairs or spines. The six-jointed antennæ and the legs are well developed; the anal lobes are placed at the extremity of the body, as in *Kermes;* and the anal ring or orifice is simple.

### Aclerda japonica (Newstead).

(Pl. XXXVI, figs. 1, 5–8; Pl. XXXVII, figs. 2, 3.)

*Aclerda japonica*, Newstead; Ent. Mo. Mag., s.s., vol. xii, p. 84, figs. 6–9 (1901).

Adult female (Pl. XXXVI, fig. 5) covering all unprotected portions of her body with closely-felted white wax, and those portions, dorsal and ventral, in contact with the food-plant with a thin white mealy wax; the secreted matter together with the food-plant forming the ovisac, which must be considered more or less incomplete.

Form elongate, about three times longer than broad, slightly widest towards the anal extremity. Antennæ (Pl. XXXVI, fig. 7 *c*) rudimentary, in the form of minute tubercles, bearing several slender hairs at the apex and a slightly longer and stouter one near the centre and also at the side. Legs absent. Ros-

trum immediately below the anterior pair of spiracles. Posterior pair of spiracles a little anterior to the centre; these organs (Pl. XXXVI, figs. 6, 6 *a*) are comparatively large; the opening, which is circular, is surrounded by a crescent-shaped flange, which is thickly set with circular spinnerets, and the inner basal portion is composed of a network of tubes. Anal cleft (Pl. XXXVII, fig. 2) short, apex forming more or less distinct angular processes, quite spine-like in some individuals; dermis on either side strongly chitinised, crenulated at the margins, and just within the latter an irregular series of circular spinnerets divided from each other by irregular wavy striæ. Anal orifice (Pl. XXXVII, fig. 3) with twenty to twenty-four very long flat hairs, so arranged at the base that they touch each other and form a section of about two thirds of a cylinder; the ring itself is attached to a large hemispherical organ which lies within a large cavity. In some individuals there are from four to six curious flattened hairs with emarginate ends proceeding from the cleft, and appearing to be attached to the hemispherical organ supporting the anal ring. Dermis at the margins with many acorn-shaped spines (Pl. XXXVI, fig. 7), some of which are hollow secreting organs attached to large subcutaneous tubes leading inwards from the spine (fig. 7 *a*); the spine sometimes breaks away, leaving a circular capitate extremity (fig. 7 *b*).

*Habitat.*—Beneath the leaf-sheaths of the food-plant (*Arundinaria japonica*), causing the sheaths to swell out at those parts which cover the insects. Under glass; Broxbourne, Herts, on imported plants. Received from the Editor of the 'Gardener's Chronicle,' Dr. Maxwell T. Masters, 26th January, 1899. The insects were living together with *Antonina socialis*, Newst., from which they cannot be distinguished without microscopical examination.

The extraordinary vitality of a female of this species is certainly not the least remarkable feature

it possessed. The first batch of specimens reached me on January 27th, the second on February 15th; after selecting a series from them for study the remainder were placed in a cardboard box, and set aside in a perfectly dry place until the September following, when I found one of the females still alive, and apparently looking none the worse for its lengthy fast of eight months! Certain of the Monophlebids have been known to survive long-extended fasts, and I believe the late Mr. Maskell was the first to call attention to this peculiar trait in the Coccidæ, but this species survived a longer fast, by many months, than any other known species.

## Explanation of the Plates.

Pl. XXXVI, fig. 1.—Insects natural size *in situ*, partly hidden beneath the leaf-sheaths (*a*, *b*) of the food-plant (*Arundinaria japonica*) in company with *Antonina socialis*.

Fig. 5.—Adult female after treatment with potash. × 10.

Fig. 6.—Spiracle of adult female: *d d*, dermis; *s*, spinnerets in crescent-shaped flange; *v*, valve closing opening; *t*, inner tubular supports; *t a*, point of tracheal attachments. × 600.

Fig. 6 *a*.—Spiracle of immature female with tracheal tubes attached. × 600.

Fig. 7.—Portion of dermis of adult female from anterior extremity with acorn-shaped spines: *a*, hollow secreting spine of similar character, with long subcutaneous inner tube; *b*, the same with spine broken away. × 600.

Fig. 7 *c*.—Rudimentary antennæ of adult female. × 250.

Fig. 8.—Anal ring of adult female, with the anal lobes (*a*) forced apart (magnified).

Pl. XXXVII, fig. 2.—Anal extremity of adult female,

showing anal cleft with hairs of anal ring slightly projecting (dorsal). × 250.

Fig. 3.—Anal ring with surrounding parts (ventral). × 600.

## Genus Lecanopsis (Targioni-Tozzetti).

Prof. Targioni-Tozzetti established this genus in 1874, setting forth the generic characters briefly as follows:—"Margin wide, with a deep anal cleft; anal lobes obtuse, approximate; antennæ short, conical, of six joints; mentum ('Os') narrow; legs short, stout; tibiæ truncate and anteriorly grooved; tarsi ovate, acute." In 1893 I ventured to extend the characters of the genus in order to include a congeneric species * possessing eight-jointed antennæ and more highly developed legs. In the following year Mr. Cockerell adopted this extension and added his *Lecanopsis lineolatæ*, which also possesses eight-jointed antennæ, suggesting, however, at the same time, that his insect apparently belonged to the genus or subgenus *Spermococcus* of Giard. In the absence of material it is somewhat difficult to decide, but judging from Mr. Cockerell's full description, I think that *L. lineolatæ* has been correctly placed.

It is difficult to understand what Targioni-Tozzetti means by the anteriorly-grooved tibiæ, and all the more so as he does not state whether the groove is longitudinal or transverse. If I understand rightly, he means that the end of the tibia is grooved for the reception of the tarsus, which is a character common to many members of the Lecaniinæ, and therefore of no generic value. Unfortunately I do not possess a description of Maskell's *L. filicum*, and cannot, therefore, say anything either with regard to its structure or its habits. All the other known species are subterranean in habit, and two of them are associated with

* *L. formicarum*, Newst., 'Ent. Mo. Mag.,' s.s., vol. iv, p. 205.

ants. *L. formicarum*, Newst., at the period of gestation, envelopes herself in a loose cottony sac, while *L. brevicornis*, Newst., covers her body with a thin talc-like secretion. But neither *L. rhizophila*, T.T., nor *L. lineolatæ*, Ckll., is known to make a secretionary covering; it is highly probable, however, that both species will be found to form an ovisac of some kind, unless they protect their ova in the same way as *Lecanium*, which is very unlikely, considering the nature of the habitat.

### Synopsis of Species.

**A.** Adult female with six-jointed antennæ.
*a.* Ovisac talc-like or glassy.
(I) . . . . BREVICORNIS.
**B.** Adult female with eight-jointed antennæ.
*a.* Ovisac woolly or cottony.
(II) . . . . FORMICARUM.

### Lecanopsis brevicornis (Newstead).

(Pl. XXXIX, figs. 1–5.)

*Lecanopsis brevicornis*, Newstead; Ent. Mo. Mag., s.s., vol. vii, p. 59, figs. 1–3, 1896.

Adult female (figs. 1, 1 *a*, and 2) bright red or reddish crimson; ovate, narrowed in front, convex above, flat beneath; dermis in life very firm and highly chitinised, more especially so at the margins; segmentation clearly defined. Antennæ (fig. 3) black at the tip, extremely short, tapering, and composed of six, and sometimes apparently of seven joints, but the apparent additional joint is due to a constriction which simulates a joint; the width of the first nearly equals the length of the remaining five joints, and each joint is successively shorter and narrower than the preceding; there is a single hair on the second and fifth joint, and there are several on the sixth. Legs (figs. 4, 4 *a*) very short, black, shining, tapering, and atrophied; coxa

very broad; trochanter somewhat triangular, bearing a rather long hair; femur, tibia, and tarsus about equal in length, the latter being slightly the shortest; digitules to claw dilated and suddenly truncate, those of the tarsi ordinary; after maceration in potash the antennæ and legs are seen to be broadly margined with dark brown chitin. Spiracles (fig. 5) very large, equalling the length of the antennæ, exterior portion trumpet-shaped, the narrow extremity attached to the centre of a very large reniform depression, which is covered on one side with a group of spinnerets, and outside the margin of the depression are several others, larger, but of similar character; three tracheal tubes radiate from each of the four spiracles, but are united at the point of attachment with the spiracle. Dermis at the sides, above, with a band of circular spinnerets, fewer in front, and absent at the posterior extremity.

Long, 2·50–3·50 mm.; wide, 1·50 mm.

Ovisac.—In what is apparently the adult stage, the female encloses herself within a very thin shell of a material resembling talc, which is irregularly cracked all over; the cracks are merely indicated by whitish lines, there is no actual separation of the material.

*Habitat.*—On grass roots amongst sand and gravel; at Snettisham, King's Lynn, Norfolk, just above high-water mark, where I first discovered it in July, 1895. Mr. Dale also obtained specimens at Llandudno, North Wales, in the following September; and I have taken a single example in the same locality.

*Distribution.*—Not known to occur outside the British Isles.

In my original diagnosis I described the species as possessing seven-jointed antennæ; I now find that I then mistook a constriction for a joint, which is very easily done when one first takes up the study of this group. The species may be recognised at once by the curious glassy test which covers the body of the female, by the short sub-rudimentary or atrophied legs and antennæ, and by the enormously developed spiracles.

Two of the specimens obtained had secreted their ovisacs; the other two were naked, and being smaller were evidently young adults; but although living they showed no signs of life, and were perfectly inert, which is most remarkable, seeing that they were not attached to any substance whatever, and I can only surmise that they had completed their final change, and were on the point of making their ovisacs prior to parturition.

The only cabinet specimen in my possession which has not been subjected to boiling potash is of an orange-brown colour; it is highly convex above, but has shrunk beneath, and is not at all unlike a dried miniature *Chiton*, having also retained its segmentation, and the extremities are curved downwards.

### Explanation of the Plate.

Pl. XXXIX, fig. 1.—Adult female removed from the glassy ovisac (dorsal). × 15.
Fig. 1 *a*.—The same (ventral). × 15.
Fig. 2.—Adult female after treatment with potash (ventral). × 20.
Fig. 3.—Antennæ of adult female. × 140.
Fig. 4.—Anterior leg of adult female. × 140.
Fig. 4 *a*.—Posterior leg of adult female. × 140.
Fig. 5.—Spiracle of adult female. × 140.

## Lecanopsis formicarum (Newstead).

(Pl. XXXIX, figs. 6–10.)

*Lecanopsis formicarum*, Newstead; Ent. Mo. Mag., s.s., vol. iv, p. 206, figs. 1–3 (1893); s.s., vol. v, p. 206 (1894).

Adult female (figs. 6, 7) enveloping herself at gestation in a loose white cottony material. Dusky yellow or reddish yellow, with two broad interrupted

subdorsal stripes of dusky purple, converging at the anal lobes, disappearing on the thoracic segment, but appearing again towards the margin in front as two distinct spots, which might be easily mistaken for the eyes. Form elongate, narrowed in front from the middle, flat convex; margins rather broad and flat; segmentation distinct. Eyes on the extreme margin, anterior to the two dorsal eye-spots, very small and nearly black. Antennæ (fig. 8) rather long, of eight joints, of which the third is longest, and the first is nearly as wide again as the second; there are two or three short hairs on the first and second joint, there is a long one on each of the fourth and fifth, followed by shorter ones on the succeeding joints, the terminal joint possessing several; formula usually 3, 1, 2, 4 (5, 6, 7, 8). Legs (figs. 9, 9 *a*) much longer than antennæ, stout, and comparatively short, with many fine short hairs, and a long one on the trochanter; apex of tibiæ produced inwardly (fig. 9 *a*); tarsi short, less than half the length of the tibiæ; digitules to claw dilate with truncate extremities; those of the tarsi ordinary. Mentum uniarticulate and very short; rostral filaments (loop) very short, scarcely longer than the basal portion of the rostrum. Spiracles large (fig. 10), exterior flange and opening approximately circular; parastigmatic glands minute, placed in a more or less circular depression; anal cleft moderately deep; anal lobes large; character of anal ring doubtful.

Long, 5–5·50 mm.; wide, 2–2·50 mm.

Larva elongate; antenna of six short wide joints, of which the third is longest, basal joint very broad. Legs short and stout, tarsi shorter than the tibiæ, digitules to claw and tarsi ordinary. Anal lobes and cleft normal; character of anal ring doubtful. Rostrum very large; mentum uniarticulate, wider than long; unexpanded filaments (loop) reaching to base of fourth abdominal segment. Abdominal segments each with a hemispherical disc, surmounted by a short slender hair,

and there are several of the same character on the margin at the cephalic extremity; stigmatic areas at margin with several large circular spinnerets, arranged in sub-groups of four or five.

*Habitat.*—On grass roots in the nest of *Formica nigra* at Chesil Beach, where it was first discovered by Mr. C. W. Dale in April, 1892. Subsequently Mr. Dale took four specimens under a stone in the same locality. These examples were recorded by him * at the time as *Ripersia Tomlinii*, Newst., but the identification proved incorrect, as was notified in the original diagnosis of the species. Judging from the specimens sent to me, and from Mr. Dale's observations, the female is active and naked up to the period of parturition, when she constructs a loose cottony ovisac. This takes place about the middle of May, and the larvæ appear shortly afterwards.

Mr. Dale's account of the insect is as follows :—"The history of *L. formicarum*, as far as I can make out, is that she spins and envelopes herself in cotton (after the manner of a moth larva) after forsaking the ants. Then the first meal of the young ones consists of the body of their mother. Your premise about the female secreting a pad of cotton beneath her is not correct, and she is viviparous, like some of the *Aphides*. I have never found any ovisacs in company with ants, and I fancy that in previous years I have been rather too early for them. I have never seen *L. formicarum* except on the Chesil Beach.

"*Beckia albinos* and *Platyarthrus Hoffmanseggii* also occur in company with the ants *Formica nigra* and *flava*, and it is a strange thing that very few Coleoptera occur in their nests. *L. formicarum* feeds on the roots of a short stiff grass which grows on sand-hills."

It seems a physiological impossibility for the larvæ to devour their parent, and I imagine that the females referred to by Mr. Dale had, in all probability, been devoured by some predaceous insect, and, very likely,

* 'Ent. Mo. Mag.,' s.s., vol. iii, p. 219 (1892).

a member of the Coleoptera, although none was discovered by Mr. Dale.

### Explanation of the Plate.

Pl. XXXIX, fig. 6.—Adult female from life (dorsal). × 8.
Fig. 7.—Adult female after treatment with potash (ventral). × 10.
Fig. 8.—Antennæ of adult female. × 140.
Fig. 9.—Leg of the adult female. × 70.
Fig. 9*a*.—Tibio-tarsal joint of adult female. × 140.
Fig. 10.—Spiracle of adult female. × 140.

## Genus Eriopeltis (Signoret).

The adult female of this genus is characterised chiefly by its very short subrudimentary or atrophied legs and antennæ, and it is scarcely distinguishable from that of *Lecanopsis*. Signoret describes the female as possessing six-jointed antennæ, but, although many individuals possess this number of joints, I find seven to be the normal number. The male puparium is described by Signoret* as waxy, and was found by him on the haulm or stem of the food-plant ("Le mâle, dont nous possédons plusieurs exemplaires trouvés sous les écailles cirreuses que l'on observe quelquefois sur le chaume de la plant"). This is extremely vague, and leaves us in doubt as to its true character. In describing two *sacs* of *E. festucæ* found by Mr. Bignell in July, 1885, Mr. J. W. Douglas says,† "One of them produced a male, the other was full of eggs." Clearly, therefore, the male puparium resembles that of the female, and is also composed of felted or woolly material (wax), in which respect it evidently resembles the male puparium of *Aclerda Berlesii*.

* 'Essai,' p. 185.
† 'Ent. Mo. Mag.,' vol. xxiv, p. 66 (1897).

The perfect male, which Signoret described from dead specimens, does not apparently possess any salient generic character, and much resembles the males of the genus *Lecanium*, but the wings are unusually long.

Should the male puparium of *Lecanopsis* prove to be of a similar character to that of *Eriopeltis*, the two genera would, I think, have to be united, and in that case the former genus would have priority.

### Eriopeltis festucæ (Fonscolombe).

(Pl. XXXVIII, figs. 1–10.)

*Coccus festucæ*, Boyer de Fonscolombe; Ann. de la Soc. Entom. de France, tome 3, pl. iii, fig. 9, p. 216 (1834).

*Eriopeltis festucæ* (Fonscolombe), Signoret; Essai, p. 184, pl. vi, fig. 3.

*Eriopeltis Lichtensteinii*, Signoret; Essai, p. 445.

Adult female in life pale dusky yellow, or dusky mauve. After treatment with potash (figs. 2, 3) very elongate, and narrowest in front (in life clypeate); anal cleft moderately deep; lobes as in *Lecanium*. Antennæ (figs. 6, 6*a*, 6*b*) very small and atrophied, normally of seven joints, but owing to certain joints being more highly chitinised and darker than others, the true articulations are not easily traced; there is also a range in the relative length of the joints, the usual formula being 2, 3 (4, 5), 7, 6, 1; apical joint with several short hairs, and there are usually one or two on the fifth and sixth joints. Legs (fig. 7) atrophied, extremely short and tapering towards the claw, but all the parts are present, viz. coxa, trochanter, tibia, and tarsus; the tarsal joint (fig. 7*a*) is a very little shorter than the tibia; digitules to claw gradually widening towards the apex, those of the tarsus faintly knobbed. Dermis above almost covered with large, conical, truncate spines (figs. 4, 5). During par-

turition the centre of the body becomes deeply folded or wrinkled, but the cephalic extremity retains indefinitely its clypeate character. Colour after death, dusky ochreous.

Long (after treatment with potash), 4–5 mm.

Long (after parturition), 2–4 mm.

Ovisac of female (figs. 1, 1*a*, 1*b*) often claviform, narrowest at the anterior extremity, flat beneath and highly convex or rounded above; composed of thick white woolly filaments, numbers of which in fresh examples (figs. 1, 1*a*) project and stand erect from the woven mass, often to a length of 6–7 mm.; but these soon disappear, and the ovisac in their absence appears to be more closely felted. During parturition the female occupies the narrow extremity of the ovisac, the cephalic portion of the body being uncovered and projecting beyond it. After parturition the female falls to the ground, leaving a circular opening for the exit of the larvæ.

Long, 5–10 mm.; wide, 2–4 mm.

Male.—Signoret's description was made from dead specimens, which he restored in potash. The antennæ and legs are apparently normal, and there are two long white caudal filaments, as in *Lecanium*. The genital armature is of a uniform width from the base to near the apex, where it is suddenly dilated and pointed, giving it the appearance of a long lance. The wings are ample and as long again as the body.

Larva (fig. 8, after treatment with potash) dark orange; very elongate. Antennæ (fig. 10) of six joints, of which the third is much the longest, formula 3, 6 (4, 5), 2, 1; on the third joint are one long and one short hair, and on the sixth a very long one and four to six shorter ones. Legs (fig. 9) nearly twice the length of the antennæ; there is a long hair on the coxa, two arise from the centre of the tibia, and two very short ones from the centre of the tarsus; digitules to claw and tarsus scarcely dilated at apex. Rostrum very large (see fig. 8); mentum very broad and

widely rounded; loop of rostrum extremely short, not reaching beyond the insertion of intermediate legs. Anal ring of six hairs. Dermis: anterior margin, above, with a series of conical spines, of which the central pair are longest and most slender; there is also a series of minute spines along the margin, indicating the articulation of each segment. Anal lobes very large, each furnished with one central long hair and a much shorter one on the inner surface.

Ova, reddish pink, laid amongst fine white filaments; I have counted 355 in one ovisac.

*Habitat.*—This extremely local insect was first discovered in this country by Mr. G. C. Bignell * on the 22nd of July, 1885, near Whitsand Bay, on *Festuca bromoides*. The only two examples of the sacs which he found there were forwarded to Mr. Douglas. Subsequently Messrs. Bignell and Scott found the species at Bickleigh; and Mr. C. O. Waterhouse found ovisacs at Folkestone Warren. It is abundant at Ince, Cheshire, but not met with elsewhere in the county. It is also abundant at Huddersfield (Mosley); and I have met with it very sparingly on the Cotswolds at Cranham, near Gloucester. It lives almost exclusively on grass, chiefly of the genus *Festuca*, and is most abundant on warm sloping banks with a dry subsoil. I have occasionally found it occupying the same leaf with *Eriococcus insignis*, Newst., and in a single instance on a leaf of the "field wood-rush" (*Luzula campestris*) with *Signoretia luzulæ*, L. Duf.

*Habits.*—This is a very difficult species to find in its early stages, and all attempts to rear it on home-grown plants have so far failed. I have only twice succeeded in finding the female before the formation of the ovisac; but I have succeeded in rearing great numbers of larvæ, which appear in the beginning of June. The female generally completes the formation of the ovisac in August, and I have often found it filled with eggs by the end of the first week of the same month.

* 'Ent. Mo. Mag.,' vol. xxii, p. 141 (1885).

The female invariably fixes herself head downwards, and usually quite close to the axil of a leaf of the food-plant, and after parturition falls to the ground and perishes. The females are subject to the attacks of a hymenopterous parasite (*Encyrtus festucæ*), which often stunt the growth of the Coccid and prevent the completion of the ovisac; and I have also known the larvæ of this parasite to completely destroy the body of the Coccid, and afterwards feed upon the eggs within the ovisac. Usually these parasites complete their metamorphoses within the body of the host.

*Distribution.*—Recorded from several parts of Europe, both north and south, Dr. Reuter having recently sent to me specimens which he obtained so far north as Abo, Finland. In 1889 Prof. A. H. Mackay found large numbers on grass in Cumberland Co., Nova Scotia, and later Dr. James Fletcher "found it in the woods on *Carex pedunculata* at Ottawa."* The following interesting account by Dr. Fletcher is taken from the 'Transactions of the Royal Society of Canada' (sect. iv, 1899, p. 216, fig. 8). He says that the cottony grass scale (*Eriopeltis festucæ*, Fonsc.) "has occasionally done harm to pastures and meadows in Nova Scotia. It was first sent in by Prof. A. H. Mackay, who stated that it occurred in large numbers over an extensive marshy flat in Cumberland Co., N.S., every blade of grass having one or more egg-sacs attached. The young insects hatch in spring, and feed on the leaves and stems of grasses, the females becoming full grown in July, and soon after the middle of the month laying their eggs in conspicuous elongated oval sacs of closely felted, white, downy threads. As the eggs do not hatch till the following spring after they are laid, burning over the 'old fog' or dead grass, either late in the autumn or before growth begins in the spring, is an easy means of preventing the increase of this insect." Mr. King (l. c.) brackets this species as introduced, and adds, "It was cited as a

* King, 'Canadian Ent.,' ? vol. xxxiii, p. 315.

new species of *Rhizococcus*, and is said to occur in Dakota, Indiana, and Illinois."

With regard to *Eriopeltis Lichtensteinii*, I should add that Signoret, in his 'Essai,' p. 445, refers to two very distinct types of ovisacs in *Eriopeltis festucæ*, one having the sac formed of curly woolly filaments, the other, on the contrary, being very densely felted. This latter form he considered distinct, and named it *Eriopeltis Lichtensteinii*, at the same time reserving the name *festucæ* for the typical species of Boyer de Fonscolombe possessing the ovisac formed of curly woolly filaments. Unfortunately Signoret did not examine the insect, and we have no further particulars concerning it. Mr. Douglas* has treated the subject at some length, and in his conclusive remarks says: "I cannot find that Signoret ever made his promised investigation, which is to be regretted. He may be right in his suggestion of two species, but the conclusion I arrived at, pending further elucidation, was that the felted sacs found in July are either the same as the long-wool ones found in October, but abraded during the winter, or, more probably, that they have been produced after hibernation from the eggs contained in the latter, and are the growth of the year; this latter proposition is more consonant with the economy of the *Lecanina*. The question is open for future investigation; in the meantime we have, nominally, two species." For a number of years past I have had the ovisacs of *Eriopeltis festucæ* under close observation, and have invariably found that when first formed the exterior is composed of very long curly or straight woolly filaments (Pl. XXXVIII, figs. 1, 1 *a*), but these delicate filaments very soon disappear, and the sac then presents a closely-felted surface (fig. 1 *b*) such as Signoret describes. On these grounds I am confident that *E. Lichtensteinii* should be placed as a synonym of *E. festucæ*.

* 'Ent. Mo. Mag.,' vol. xxiv, p. 166 (1887).

## Explanation of the Plate.

Pl. XXXVIII, figs. 1–1*b*.—Insects natural size *in situ* on grass (*Festuca* sp.); 1*a* represents a newly-formed ovisac, 1*b* the older and more closely-felted ovisacs.

Fig. 2.—Adult female after treatment with potash (dorsal). × 12.

Fig. 3.—Adult female after treatment with potash (ventral). × 12.

Fig. 4.—Dermis of adult female with truncate spines (dorsal). × 140.

Fig. 5.—Truncate spine. × 600.

Figs. 6, 6*a*, 6*b*.—Antennæ of adult female. × 140.

Fig. 7.—Leg of the adult female. × 140.

Fig. 7*a*.—Tarsus and claw of adult female. × 300.

Fig. 8.—Larva after treatment with potash (ventral). × 70.

Fig. 9.—Leg of the larva. × 300.

Fig. 10.—Antenna of the larva. × 300.

## Genus Signoretia (Targioni-Tozzetti).

Adult female narrowly elongate. The antennæ of eight joints, and the legs well developed. Anal ring with six hairs. Ovisac of female very elongate, sometimes clavate, closely felted, and open at the narrow anterior extremity. Male with a short styliform genital armature. No caudal filaments.

Male puparium (Pl. XL, fig. 12) glassy, elongate, with the ends rounded, and rather deep *perpendicular* sides, which give it a somewhat box-shaped form.

Here it will be seen that the characters of the male and its puparium help materially in the establishment of the genus, which is rarely the case in the males of this sub-family. The European *Signoretia luzulæ*, L. Dufour, is the only member of the genus, but Mr.

Maskell * has described a variety from Australia (var. *australis*), which, from its yellowish-brown colour, certain minute differences, and the greater size of the puparium, may very probably take rank as a distinct species.

### Signoretia luzulæ (L. Dufour).

(Pl. XL, figs. 1–12.)

*Aspidiotus ? luzulæ*, L. Dufour; Ann. Soc. Ent. Fr., 3 ser., vol. iv, p. 208, pl. v, fig. 4 (1864).
*Signoretia luzulæ*, Signoret; Essai, p. 181, pl. vi, figs. 1 *a*, *b*, *c*.
*Signoretia clypeata*, Targioni-Tozzetti; Catal., p. 34 (1868).

Adult female (fig. 3) very elongate, sides almost parallel, posterior extremity gradually rounded, anterior extremity rather suddenly so, and it is produced and extends considerably beyond the insertion of the antennæ. Dermis with fine short hairs along the margin, and many very long ones on all the abdominal segments and thoracic and cephalic areas; stigmatic areas (fig. 7) with two blunt, horn-shaped spines, and a few spinnerets. Anal ring (fig. 6) with six comparatively long hairs; the retractile sac, to which the ring is attached, is short, and when extended is spherical in shape; when retracted the hairs scarcely extend beyond the anal lobes; the latter have the anal angles frequently obtuse, and are furnished with one or more apical hairs. Antennæ (figs. 4, 4 *a*) of eight joints, of which the third, fourth, and fifth are longest; there are three hairs on the fifth, two on the sixth and seventh, and several on the apical joint; all are short and slender; formula 3, 4, 5, 2, 1 (6, 7, 8). Legs (fig. 5) longer than the antennæ, slender; there is a

* 'Trans. New Zealand Inst.,' vol. xxv, p. 223 (1892).

long hair on the coxæ, and there are several short ones on the tibiæ and tarsi; digitules to claw dilated and broadly rounded at the apex, those of the tarsi ordinary. Rostrum (see fig. 3) placed opposite the insertion of the anterior pair of legs; mentum extremely short; loop of rostral filaments scarcely longer than the mentum.

Long, 2·50–4 mm.; wide, ·75–1·25 mm.

The ovisac of the female (fig. 1) is composed of a closely-felted white wax, more or less claviform, highly convex above, narrowed and extended in front, where the female closes it until after parturition, when she drops out and leaves a nearly circular opening.

Long, 4–6·25 mm.

Female at period of fecundation (fig. 2) very elongate, sides parallel, ends equally rounded; pale or dark orange-yellow, with two broad subdorsal bands of rich dark carmine, which under the microscope are seen to be made up of small, more or less confluent spots, and the bands are interrupted at the articulations of the segments. Eyes black, situate on the margin at the side considerably below the extremity. Antennæ, anal ring, rostrum, and legs, as in the adult.

Long, 2·50–3·25 mm.; wide, ·75–1 mm.

Male (fig. 8) coral-red or dull red, thoracic plates dark crimson; eyes and ocelli black; antennæ, legs, and stylus paler; wings narrow, nearly as long again as the body; costal nerve and space reddish; head somewhat cordate, apex in front with several very short hairs. Antennæ (fig. 9) of ten joints, all furnished with numerous fine short hairs, and the apical joint has, in addition, three long clubbed hairs; the first joint is almost spherical; the second, about equal in length to the first, has the outer basal portions highly chitinised and produced into angular spine-like projections. Legs (fig. 10) rather slender, and thickly set with fine hairs, and there is a long spine-like hair extending from the inner projecting extremity of the tibiæ; digitules to claw and tarsi ordinary. Each of the

last three abdominal segments bears a single tubercle at the margin, of which the central one is much the largest, the smaller ones being imperceptible in some of the mounted specimens. Stylus or genital sheath very short, flat, and obtusely pointed at the apex. Dermis forming the genæ, and transverse band which connects them, finely reticulated; thorax with a few fine, scattered hairs, and there is a row of widely separated hairs along the margins of the abdominal segments.

Long, 1 mm.

Puparium of the male (figs. 1 ♂ and 12) glassy, semi-opaque, white, elongate, sides almost parallel, low convex above, with a faint central carina; there is also a faint curved carina in front, arising from each of the anterior spiracular areas, and at about the same distance from the posterior extremity is another carina which is more sharply defined, and gives the puparium the appearance of being hinged at this point; sides perpendicular, or slightly sloping inwards, highest in front, and terminating just beyond the posterior transverse carina. Anal cleft as in *Lecanium*.

Long, 1 mm.

Second-stage male (fig. 11), immediately prior to the formation of the puparium, very elongate, sides parallel, ends equally rounded; margins slightly constricted at the stigmatic openings; yellow, or greenish yellow, with two broad subdorsal bands of crimson formed of small, and more or less confluent spots, interrupted by five transverse bands of the ground colour, extending from the central greenish-yellow carinæ.

Long, 1 mm.

*Habitat.*—This species is apparently confined to the field wood-rush (*Luzula campestris*), and loves a shaded and rather moist situation.

I have found it abundant on a high sloping embankment, having a north aspect, at Ince, Cheshire, where I discovered it for the first time in this country in May,

1890. I have also found it sparingly on plants growing beneath gorse (*Ulex europæus*) on a piece of heathy ground at Briston, near East Dereham, Norfolk, where the ground was decidedly moist from the overshadowing branches of the gorse. I have found it still more sparingly in openings in the Cranham Woods, near Stroud, Gloucestershire, on plants almost hidden amongst grasses and *Helianthemum vulgare;* all the ovisacs were quite concealed, and I did not discover them until I had divided the surrounding herbage.

*Habits.*—The eggs, which are pinkish in colour, are laid during the formation of the ovisac, and also during a short time after its completion; this takes place towards the end of July and early in August. The eggs remain throughout the winter in the ovisac, the larvæ hatching in spring. Until the males are ready to pupate, the sexes live together on the upper surfaces of the leaves of the food-plant. In June the majority of the second-stage males walk from the upper to the under sides of the leaves, and there construct their puparia and undergo their final change; this occupies a period of about fourteen days; the perfect males emerge towards the end of June and early in July. Although the females are usually stationary, many examples may be seen walking about the food-plants, evidently searching for more favourable quarters, and should they be unduly confined in the collecting-box, numbers of them will wander aimlessly about, a habit rarely attained in other plant-feeding Lecaniinæ. The females may, therefore, be considered active up to the period of parturition; moreover, if placed upon their backs they readily regain their feet by bringing their extremities together. Fecundation takes place immediately on the appearance of the males. Early in August the females have completed the formation of their ovisacs, which occupies a period of from twelve to sixteen days; many examples begin to "spin" early in July, and during the whole process the cephalic portion of the body remains

uncovered. For some time afterwards the insects remain at the extremity of the ovisac, but they eventually work their way out of the sac, fall to the ground, and perish. The body changes very much in character after parturition, the central portion being deeply wrinkled transversely, as in *Pulvinaria*, but the anterior portion retains a distinctly clypeate form. The brilliant colouring is also eventually lost, and a dull ochreous tint extends over the whole body. Parasitised females, which are very rare, remain in the ovisac after parturition, which is a proof that the Coccid is either killed, or so paralysed that it is unable to escape. I have noted the same habit in parasitised examples of *Eriopeltis festucæ*. I should add that shortly before the formation of the ovisac the females effect their last moult, and while witnessing the act under the microscope I distinctly saw a female make use of its anal ring, apparently to detach its partly-discarded skin from the sides of the anal cleft, which it did by constantly protruding the telescopic tube to which the anal ring is attached; the abdomen was also frequently elevated, but I am inclined to take this as one of the traits of fecundation, as I have observed it in a species of *Pseudococcus*, and, moreover, I also find that many Coccids are fecundated immediately after the final moult. Brilliantly coloured as the females are, they are by no means conspicuous, as the leaves upon which they feed are generally stained with orange, brown, and red, and shaded purples; and I am not at all sure that the insects do not cause some of the brighter stains.

*Distribution.*—Signoret found it in great abundance in the south of France, and in the Forest of Clamart, and he also received it from Targioni-Tozzetti, from Italy. Apparently it has not been met with elsewhere out of Britain.

## Explanation of the Plate.

Pl. XL, fig. 1.—Insects natural size *in situ* on a plant of *Luzula campestris:* ♀ indicates females immediately prior to the formation of the ovisac; ♀ s = female sacs; and ♂ = male puparia on under side of leaf.

Fig. 2.—Second stage female. × 15.

Fig. 3.—Adult female after treatment with potash. × 15.

Figs. 4, 4 *a*.—Antennæ of adult female. × 140.

Fig. 5.—Tibia and tarsus of adult female. × 140.

Fig. 6.—Anal ring of adult female with the basal retractile sac fully extended and the anal lobes diverted. × 140.

Fig. 7.—Stigmatic spines and spinnerets. × 300.

Fig. 8.—Male. × 30.

Fig. 9.—Antenna of the male. × 70.

Fig. 10.—Leg of the male. × 70.

Fig. 11.—Second-stage male. × 35.

Fig. 12.—Puparia of the male. × 20.

## Genus Lichtensia (Signoret).

Adult female (Pl. XLI, fig. 3) naked and more or less active up to the period of parturition, when it much resembles certain forms of *Lecanium hesperidum*. Immediately before parturition the female envelopes herself, except at the cephalic extremity, in a dense white felted sac (Pl. XLI, fig. 1). Antennæ and legs well-developed.

Male (Pl. XLI, fig. 7) with two long white caudal filaments. Ocelli, four ventral and four dorsal.

Male puparium (Pl. XLI, fig. 11) glassy, with the "coronet" bifurcate at the posterior extremity.

This genus comes very near to the preceding in the structural details of the adult female, and also in the

form of the ovisac, but may be readily separated from *Signoretia* by the long caudal filaments of the male, and the curious, anteriorly bifurcate character of the coronet of the male puparium. Were it not for the distinctive features of the male and its puparium it would be impossible to separate the females of the respective genera.

This comparatively small genus, consisting of about seven or eight species, is represented in Australia, Brazil, Mexico, Egypt, and Europe. *L. viburni*, Lichtenstein, is the only known European species, and forms the type of the genus. The most remarkable species is *L. lutea*, Cockerell, the ovisac being of a silky texture, and of a beautiful golden yellow colour. It was discovered by Mr. Cockerell at Vera Cruz, Mexico, in 1893.

### Lichtensia viburni (Lichtenstein, MS., Signoret).

(Pl. XLI, figs. 1–11).

*Lichtensia viburni* (Lichtenstein, MS.), Signoret; Essai, p. 204, pl. ii, figs. 7, 7 *a*.
*Lichtensia viburni* (Signoret), Douglas; Ent. Mo. Mag., vol. xxiv, p. 167 (1887).
*Lichtensia viburni* (Signoret), Newstead; Ent. Mo. Mag., s.s., vol. vi, p. 165, figs. 1–3 (1895).

Adult female immediately prior to the formation of the ovisac (figs. 2, 3), dusky lemon-yellow, or greenish yellow, and either with or without irregular, wavy, dusky markings on each side of a clear median space; form elongate with the extremities equally rounded, and the margin set with fine equidistant white hairs; under side paler. Antennæ (figs. 4, 4 *a*) of eight joints, of which the third is the longest; formula 3, 4, 2, 8 (5, 6), 7, 1, or 3 (4, 5), 2, 8, 6, 7, 1; the first joint in all cases is much the widest, the longest hair is on the second joint. Legs (fig. 5) very large, and

much longer than the antennæ; there are several hairs arising from the apex of the femur, several on the lower portion of the tibia, and two very minute ones on the underside of the tarsus; digitules to claw nearly as long again as the latter and very broadly dilated at the apex; those of the tarsi are slightly thickened at the apex, but are not knobbed. Stigmatic area (fig. 6) with three spines and a small group of spinnerets. Marginal spines (fig. 6 *a*) shaped like a mason's chisel, being gradually flattened towards the extremity and suddenly truncate; they are probably hollow secreting organs, as there is a distinct trace of a groove or channel on the flattened portion near the apex. Mentum monomerous; loop of rostrum shorter than antennæ. Inner margin of anal lobes with two hairs. Anal ring with eight hairs.

Long, 3·50–5 mm.; wide, 2·40–3 mm.

Ovisac of female (fig. 1) elongate-ovate, slightly narrowed in front, flat convex, and composed of a rather compactly-woven white cottony material, open at the anterior extremity, where the body of the female permanently closes it.

Long, 4–6 mm.; wide, 2·25–3 mm.

Male (fig. 7).—Colour deep orange-yellow; head, apodema, and all chitinised portions of thorax, as well as the deepened portions of the abdomen, orange brown or pale brown; legs dusky yellow, or dull orange brown; eyes and ocelli shining black; wings beautifully iridescent under strong reflected light; costal nervure roseate. Stylus comparatively short and pointed. The white caudal filaments are nearly as long again as the body. Eyes (fig. 8 *a*), rather large, placed just below the antennæ; and just within the latter and towards the apex of the head is a pair of larger ocelli, and above the genæ a second pair of very minute ones (fig. 8 *b*); ventral ocelli (fig. 9 *b*) four, the lower pair largest, each situate in the centre of a more or less triangular plate.

Expanse of wing, 3 mm.

Pupa (fig. 10) yellow; eyes and parts of the thorax reddish crimson; sheaths of legs and antennæ glassy. Abdomen terminating with three pointed tubercles.

Long, 1·50–2 mm.

Puparium of male (fig. 11) glassy white, but it appears to be shaded with bottle-green when fixed to the green leaf of the food-plant. Anal cleft normal. The central "coronet" is composed of double carinæ, and is bifurcated in front or V-shaped, the arms extending to the outer margin; central, enclosed area, linear, convex, and segmented; there is a central pair of transverse carinæ, and a second pair extending from near the posterior extremity of the coronet, and projected backwards.

Long, 1·50–2 mm.

Ova white.

Larva pale yellow. Details as in *Lecanium*, including the anal ring of six hairs.

*Habitat.*—On ivy (*Hedera helix*) and laurustinus (*Viburnum tinus*). In this country the species is partial to the ivy, and apparently prefers that which covers walls and buildings, but I have received it from ivy taken from the ground at the bottom of a hawthorn hedge.

Mr. G. C. Bignell first discovered the species at Stonehouse, Devon, and the specimens formed the subject of a long article by Mr. Douglas.* It has subsequently been found in great abundance at Llandaff (Tomlin); at Bangor, North Wales (F. V. Dutton); I found it abundant at Painswick, Gloucestershire; and more sparingly at King's Langley and Tring, Herts. My friend Mr. Thomas Shepheard, of Bournemouth, is the only person who has found the species on laurustinus in this country, and he informs me that it is very common in his district, where he also finds it upon ivy.

*Habits.*—The eggs are laid about the middle of May, during the formation and shortly after the completion

* 'Ent. Mo. Mag.,' vol. xxiv, p. 167 (1887).

of the ovisac. The larvæ hatch towards the end of June, fixing themselves down on various parts of both the upper and under sides of the leaves of the food-plant. The earliest male to appear was on the 25th of April, 1894, but in late seasons I have known one to appear as late as the 24th of May. Pupation usually takes place on the leaves of the food-plant. The majority of immature females migrate from the leaves in spring, and fix themselves to the tender branches of the ivy, but most of them return again to the leaves to spin up. The cottony material first secreted is attached to the body of the insect, and is less compact than the finished ovisac; the secretion appears on every part of the body except the cephalic extremity, which remains uncovered. The time occupied in the formation of the ovisac is only about four to five days, the first coat being very rapidly secreted.

*Distribution.* — Discovered by M. Lichtenstein at Montpelier, France, but I believe it has not been met with elsewhere on the continent of Europe, nor in any other part of the world besides Britain.

## Explanation of the Plate.

Pl. XLI, fig. 1.—Insects (male puparia and female ovisacs) natural size *in situ* on ivy leaf.
Fig. 2.—Adult females natural size immediately prior to the formation of the ovisac, on branch of ivy.
Fig. 3.—The same. × 7.
Figs. 4, 4 *a*.—Antennæ of adult female. × 140.
Fig. 5.—Leg of the adult female. × 140.
Fig. 5 *a*.—Tarsus and claw of adult female. × 300.
Fig. 6.—Stigmatic area of adult female with spines and grouped spinnerets. × 300.
Fig. 6 *a*.—Marginal spines of adult female. × 300.
Fig. 7.—Male. × 25.
Fig. 8.—Head of male (dorsal); *a*, eye; *b*, ocelli. × 100.

Fig. 9.—The same (ventral); *a*, eye; *b*, ocelli. × 100.
Fig. 10.—Pupa. × 25.
Fig. 11.—Male puparium. × 25.

## Genus Ceroplastes (Gray).

This genus embraces some very remarkable and intensely interesting forms. The females from the earliest stage cover their bodies with a test of wax, varying greatly both in substance and form, but in all cases it is apparently inseparable from the body of the insect. The only species yet met with in this country may be considered typical of the genus, of which two similar types occur in the open air in southern Europe. But the departure from such forms is very great. *C. ceriferus*, Anderson, in its early stages much resembles the species hereafter described, but as the insect advances to maturity the cereous covering loses all trace of design, and forms around the body of the female a very thick, almost shapeless, mass, which is collected and made into candles (see vol. i, p. 16). *C. utilis*, Ckll., is evidently a similar species. Mr. Cockerell says of this that when a number of individuals occur together "the wax unites and surrounds the branch as the wick of a candle is surrounded with wax." In the South American *C. denudatus*, Ckll., the waxen plates which form so marked a feature in the young adults fall away as the insects mature, leaving the insect perfectly naked, when its hollow, hemispherical body might easily pass for a species of *Lecanium*. South America has also produced other remarkable forms, but none more so than the magnificent *C. grandis*, discovered and described* by Prof. Hempel. *C. depressus*, Ckll., is remarkable for its flatness, its shape being adapted for its habitat, which is under the bark of its food-plant, the lignum-vitæ. Like *C. utilis*, it is a native of the West Indies.

* As *Coccidas Brazileiras*, 'Revista d. mus. Paulista,' vol. iv, p. 109, pl. viii, figs. 13, 14.

The formation of the cereous test of the female may be gathered by a study of the figures on Pl. XLII. In the earliest stages the body is covered with a thick coat of dark crimson wax (fig. 12), which is divided into eight marginal plates and one large dorsal plate; the latter has a large central elliptic boss of snow-white wax, and each of the marginal plates a central square appendage of the same snow-white cereous matter, while the anterior plate has three narrow appendages and the posterior plate possesses two. After this stage is reached a change evidently takes place in the insect, and it is probably furnished with a new set of secreting organs, as the wax which is subsequently secreted not only takes a new form, but is of a beautiful pinkish-white (fig. 11*a*). After the formation of the marginal plates a quantity of wax is secreted on the dorsum, which raises the test in front considerably, giving it a somewhat limpet-like form. In such examples one can clearly see the wax which was first secreted by the larva, the snow-white appendages with the dark crimson portion surrounding them being incorporated into the wax which was subsequently secreted, forming, as it were, large central nuclei. But as the insects advance to maturity the test becomes highly convex (figs. 1*a*, 1*c*), and, although the white appendages of the larva with the surrounding crimson parts are still traceable, they become much smaller, and sometimes are entirely wanting. At parturition the body of the female gradually shrinks, as in *Lecanium* and *Vinsonia*, and the insect becomes a hollow hemisphere, filled, as in *Lecanium*, with eggs.

I believe that the only known male of this rather extensive genus is that of *Ceroplastes ceriferus*. The specimens were collected by Miss L. E. Tomlin during a visit to Madras in 1892–3, and I think that an abstract from my original account of the insects may not be without interest.* The specimens were found on a "low bushy shrub (*Asclepiadrom*) growing in sandy

* 'Indian Museum Notes,' vol. iii (5), p. 21.

soil at Seven Pagodas, Madras, in February, 1893, and were carefully packed and forwarded to me. There were many examples of the adult female on the stems of the food-plant, with their thick, regular coverings of white wax, but there were neither eggs nor larvæ in them. Judging from the colour and condition of the wax, I should say that the females had been dead some time; and this is what one would expect, as the young females were, when taken, at the period of fecundation. On the leaves, and more rarely on the stems, were numerous examples of the young females (second stage), and scales (puparia) of the male; all of the latter were apparently empty. On looking carefully over the *débris* at the bottom of the packet I found many examples of the perfect male which delighted me, for hitherto not a single male of any of the known species of the genus *Ceroplastes* had been discovered. Undoubtedly the males must have been hatched during transit, and it is well that Miss Tomlin collected them when she did, or we should have had but their empty scales to tell that they had existed.

"Restored specimens of the male, reddish brown, body rather short, wide; eyes black, large and prominent; the two ocelli beneath, small; antennæ of ten joints, third longest, all with many fine hairs and deeply notched sides. Legs ordinary. Wings rather short. Genital armature somewhat triangular, with a large, thin, projecting, funnel-shaped organ. Anal lobes each with one very long hair and one or more short ones; lobes with numerous circular discs. The long anal setæ in life would no doubt be covered with white wax, forming long white filaments. . . . In all the specimens examined the white covering was wanting, and no doubt was broken away during transit.

"Scale (puparium) of the male opaque glassy white, with a broad central, and three lateral carinæ; the central ones meeting form a complete loop.

"Long, 2–2·50 mm."

It will be seen from the foregoing that the genital armature of the male is very distinct, and it may, I think, be considered of generic importance. The puparium, however, strongly resembles the puparia of the genus *Lecanium*, which shows the close affinity of *Ceroplastes* to that genus.

### Ceroplastes cistudiformis (Townsend, MS.).

(Pl. XLII, figs. 1–12.)

*Ceroplastes psidii cistudiformis* (Townsend, MS.), Cockerell; Zoe, vol. iv, No. 1, April, 1893.

External waxy test or pellicle of old adult female (figs. 1, 1 *a*, 1 *c*) obconical and usually compressed at the sides, giving it an ovate outline at the base; comparatively smooth, and evenly rounded from the apex downwards towards the lateral white "nuclei" or appendages, which are situate in deep depressions; marginal and dorsal plates absent or but very faintly indicated; apical dorsal nucleus infrequently surrounded with dull crimson and a patch of grey, following which is a zone of greyish-brown with radiating lines of the same colour extending into a broad bluish-grey zone, which also extends downwards along the elevated portions to the margins; marginal depressions broadly greyish-brown; margin white or greyish. Cabinet specimens change to a uniform purplish-black with a slightly farinose surface.

Long, 5–8 mm.; wide, 3·75–5 mm.; high, 4–6 mm.

Old adult female forming a hollow hemisphere after parturition; dermis semi-transparent, and there is no horn-like projection at the anal extremity, as in some species. Antennæ (fig. 3) of eight joints, the second, third, fourth, and fifth being longest and almost equal in length; formula * (3, 4) (2, 5) 1 (6, 7, 8). Legs (fig. 2) rather strong; digitules to claw (fig. 2 *a*) dilated

* I have only been successful in mounting one antenna, and cannot therefore say if there be any marked variation in the antennal joints.

both at base and apex, and so large as to almost obscure the claw; those of the tarsi ordinary. Spiracles (fig. 5) trumpet-shaped; parastigmatic glands minute. Dermis (fig. 4) with numerous circular pores, and a very faint tessellation.

Test or pellicle of young adult female (fig. 11 *b*) somewhat limpet-shaped, with one dorsal and eight irregular square-sided marginal plates of pinkish wax; each of the six lateral plates with a single central, more or less square, opaque, snow-white, projecting appendage; anterior plate with three, posterior plate with two, much smaller and more pointed, all being surrounded by a broad band of rich dark crimson, which gradually shades off into the surrounding wax; dorsal plate with the central white appendage very elongate, placed horizontally in young individuals, but tilted anteriorly in older examples.

Long, 3–3·50 mm.; wide, 1·50–2 mm.; high, 1·50–2 mm.

Young adult female (fig. 6) short, ovate; legs and antennæ well developed; dermis transparent, except at the region of the anal lobes, where it is more highly chitinised. Anal cleft rather short; anal lobes highly chitinised and brown, form normal. Stigmatic spines (fig. 9) conical, a few of the inner examples much larger than the rest; the whole group numbers about eighty, and occupies an extended triangle immediately within the margin. Marginal hairs (fig. 9 *a*) simple and minute.

Long, 1·25–2 mm.; wide, 1–1·50 mm.

Test or pellicle of fully-developed larva (fig. 12) with the same number of plates as in the young adult female, but the wax is of a rich dark crimson, and the opaque white appendages are larger and more distinct.

Long, 1–1·25 mm.

*Habitat* (under glass).—On an orchid (*Chrysis bractescens*) at Tring Park, the seat of Lord Rothschild, father of the Hon. Walter Rothschild, to whom I am indebted, through Dr. K. Jordan, for a liberal supply

of specimens of this remarkable insect. Dr. Jordan informs me that the insect was originally discovered on an orchid at Harrow by Mr. James O'Brien in 1897, and the Hon. N. Charles Rothschild tells me (1901) that it is still "cultivated at Tring for the sake of its beauty, and that it reproduces in numbers every year and dies." It does not apparently increase in numbers or injure the plant.

*Distribution.*—Mr. Cockerell's types were from Guanajuato, Mexico, on *Bignonia* and *Chrysanthemum*.

## Explanation of the Plate.

Pl. XLII, fig. 1.—Female insects natural size *in situ* on a portion of an orchid (*Chrysis bractescens*). *a*, old adults; *b*, young adults.

Fig. 1 *c*.—Old adult female. × 2.

Fig. 2.—Leg of old adult female. × 140.

Fig. 2 *a*.—Tarsus and claw of same. × 300.

Fig. 3.—Antenna of old adult female. × 140.

Fig. 4.—Dorsal dermis of old adult female. × 140.

Fig. 5.—Spiracle of old adult female. × 140.

Fig. 6.—Young adult female after treatment with potash (ventral). × 10.

Fig. 7.—Antenna of young adult female. × 140.

Fig. 8.—Tibia and tarsus of young adult female. × 140.

Fig. 9.—Stigmatic spines of young adult female. × 300.

Fig. 10.—Dermis of young adult female. × 600.

Fig. 11.—Young adult females, showing two stages (*a* and *b*) of the tests or pellicles. × 7.

Fig. 12.—Fully-developed larva or first stage female. × 10.

## Genus Vinsonia (Signoret).

Only one species of this remarkable genus is known. The cereous test in quite young individuals (Pl. XLIV, figs. 12, 13) bears a striking resemblance to the young forms of certain species of *Ceroplastes*, *e. g. C. ceriferus*, Anderson, and *C. testudiformis*, Townsend; but the test of the adult insect is quite distinct from all others in the remarkable resemblance it bears to the star of an order of rank and merit. Apart from the distinct character of the female test, the genus is distinguished by the *cephalic articulation* in the adult female (Pl. XLIII, fig. 4), and also by the distinctive character of the puparium of the male (Pl. XLIV, figs. 10, 11), which possesses the radiating arms, as in the test of the female, to which it bears such a striking resemblance that it is easy to mistake the sexes in their early stages.

At first sight it is difficult to account for the remarkable formation of the cereous matter in either sex, but by carefully studying a series of specimens in their various stages the process may be followed with some certainty. In the earliest stage the female larva secretes the wax in the form shown on Pl. XLIV, fig. 12, which consists of one dorsal and seven marginal appendages; the anterior appendage is divided at the sides near the base, giving it a tridentate character, the lateral appendages being smooth, as also are the four smaller ones at the posterior extremity. After the formation of these appendages the insect in all probability casts its skin, and is then provided with a fresh set of secreting organs, which commence to secrete all over the body a more or less uniform layer of semitransparent, glass-like wax, which adheres very firmly to the snow-white appendages secreted by the first larval stage. As the insect matures, the process of secreting clear wax still goes on, and as it widens, the snow-white appendages are gradually pushed outwards until

eventually they appear as white tips to the broad rays of glass-like wax. After the test has attained its greatest lateral dimensions the female begins to assume a more convex form, eventually becoming more or less hemispherical (Pl. XLIII, figs. 2, 3), the wax covering her body at this period being very thin and brittle; but the only naked portion of her body is the little horn-like projection at the posterior portion of the test. The test in old examples rarely remains intact for any great length of time; the arms eventually get broken away, and the test is often otherwise incomplete. Like the hemispherical species of *Lecanium*, the body of the female becomes a hollow hemisphere protecting the eggs, and subsequently the young larvæ.

The formation of the male puparium is apparently accomplished in the same way as is the test of the female, and pupation evidently takes place after its completion.

The number and arrangement of the male ocelli may hereafter form a feature of the genus, but as our knowledge of male coccids is very small, I do not at the present moment deem it advisable to more than call attention to them.

### VINSONIA STELLIFERA (Westwood).

(Pl. XLIII, figs. 1–12, ♀; Pl. XLIV, figs. 1–14, ♂.)

*Coccus stellifer*, Westwood; Trans. Ent. Soc. Lond., 1871, Proc., p. 3.

*Vinsonia pulchella*, Signoret; Essai, p. 190, pl. vii, fig. 7.

Cereous test of old adult female (Pl. XLIII, figs. 2, 3) semitransparent, glassy, and very brittle; central area more or less hemispherical, very thin, and with the body of the sublying female showing through, giving the test an orange-brown or chestnut-brown colour in the thinnest portions; at the margin of the convex portion the test thickens, and extends

considerably beyond the body of the female, suddenly dividing into seven distinct rays or arms, one anterior and three lateral, each of which has the tip opaque, snow-white, and faintly striated longitudinally; the anterior pair of lateral arms are strongly and sharply ridged, and there is a very narrow, opaque, snow-white line of secretion along the ridge of each; there are also four similar but much smaller appendages at the extremity of the anal margin, of which the outer pair are much the longest and stoutest; and there is a central dorsal boss of the same snow-white material.

Wide, 2–3 mm.

Old adult female (Pl. XLIII, fig. 4), denuded of its cereous test, orange-brown or chestnut-brown, varying according to age; the oldest examples are darkest; form more or less hemispherical, slightly compressed at the sides, cephalic extremity produced and *articulated;* posterior extremity with a horn-shaped process, carrying the angular anal lobes and anal ring; the whole body is highly chitinised, very strong, and opaque. Cephalic projection (Pl. XLIII, fig. 5) on the ventral surface with a series of circular spinnerets, taking the same contour as the margin, and there are also numerous larger glands or pores which gradually diminish towards the margin; dermis forming the articulation thin and non-chitinised; it also bears a number of glands (Pl. XLIII, fig. 5 *a*). Antennæ (Pl. XLIII, figs. 6, 6 *a*), attached to cephalic extension at the point of articulation with the body (fig. 5), of six joints, of which the third is much the longest; the first joint is highly chitinised at the base, but transparent towards its articulation with the second; formula 3, 2, 1 (4, 5, 6), or 3, 1, 2 (4, 5, 6). Rostrum (Pl. XLIII, fig. 5) arising from the centre of the cephalic articulation, small; mentum uniarticulate; rostral loop short, and not extending beyond insertion of anterior legs. Stigmatic area (Pl. XLIII, fig. 5 *b*) deeply emarginate, with about twelve short spines; spiracles (Pl. XLIII, fig. 12) trumpet-shaped, but with a projecting lip, as in some

of the Diaspinæ. Legs (Pl. XLIII, figs. 7, 8) short, anterior pair usually contracted, intermediate and posterior pairs more or less straight; on the trochanter there is a long hair, and on the tarsus there are about three minute ones; digitules to claw very large, dilated at both extremities, but more so at the apex. Anal lobes (Pl. XLIII, fig. 9) with three long hairs; anal ring of six hairs (Pl. XLIII, fig. 10) attached to a very long retractile sac.

First larval test of female (Pl. XLIV, fig. 12) with the central snow-white boss completely covering the dorsum of the sublying insect; the anterior and three lateral arms, and also the four posterior appendages, correspond with those at the extremity of the rays or arms in the adult.

The test of the female at its period of fecundation (Pl. XLIV, fig. 13) resembles the former, but more of the clear, glass-like wax is added, which pushes away the snow-white appendages from the sides of the body, the latter showing through the test and giving it a pale bottle-green colour.

Female after fecundation with the cereous test differing only from that of the adult insect in having the central area flat, the expanse of the rays or arms being almost as great as in the adult insect.

Wide, 2 mm.

Male (Pl. XLIV, fig. 1) of a pale, dull red colour, the thorax paler; the apodema darker; the collar dusky yellow; eyes and ocelli black; antennæ and legs paler than the body; wings iridescent; costal nervure roseate; form short and very broad. Antennæ of ten joints, thickly set with rather long hairs, apical joint (Pl. XLIV, fig. 2) with two* additional knobbed hairs. Legs (Pl. XLIV, fig. 3) very long, hairy; tarsus (fig. 4) about half the length of the tibia; digitules to claw and tarsus short and knobbed.

* My examples unfortunately got broken in preparing them for study, and I am not quite certain if the number of knobbed hairs is correctly given; the only terminal joint appears to be perfect.

Genital armature (Pl. XLIV, fig. 8) with a short, suddenly-pointed stylus, having a long ventral slit and an opening at the extremity for the penis. Anal lobes large and very hairy. Dermis on certain parts of the head finely reticulated (Pl. XLIV, fig. 7). Eyes (Pl. XLIV, fig. 6) placed considerably below the antennæ at the extreme anterior margin of the genæ. There is only one pair of dorsal ocelli, which are so placed at the extreme margin in front that they are partly seen from the ventral surface of the head (Pl. XLIV, fig. 5); the single pair of ventral ocelli are placed on the rounded posterior margin.

Long, 1·25 mm. Expanse of wing, 2·25 mm.

Puparium of male (Pl. XLIV, figs. 10, 11) formed of the same glassy cereous matter as the test of the female, and like it also in having one anterior and three lateral rays or arms; but there are two additional short posterior rays, each furnished at the extremity with three snow-white appendages, and the outline is much more elongate. Central area hollow, very elongate, flat beneath, and convex above, with a central snow-white ovate boss. Anal cleft present, but often rather faintly indicated.

Long, 1·75–2 mm.

Larva in life dusky yellow, with dark brown eyes, and the margin of the body with downward and inwardly-curved hairs. These latter would very probably appear quite straight in mounted specimens, but I unfortunately did not prepare specimens for microscopical study. In general appearance the larvæ are inseparable from those of *Lecanium*, and it is doubtful if they possess any distinctive character of generic importance.

Ova pinkish-yellow.

*Habitat.*—Prof. Westwood's specimens were from the leaves of the orchid *Cypripedium niveum*, from Siam, and were briefly described (l. c.) in the report of the meeting of the Entomological Society of London on 6th February, 1871, and subsequently described in the

'Gardener's Chronicle' for 1871, at p. 1006. I have taken the species at Eaton, near Chester, on comparatively recently-imported orchids, and have received it from Liverpool. On 31st October, 1901, I received, through Mr. George S. Saunders, from the scientific committee of the Royal Horticultural Society, on the leaf of an orchid (*Cypripedium Godfroyæ*, var. *leucochretum*), about forty examples of this beautiful species, which on examination proved to be nearly all male puparia, several of which were tenanted, and the males were nearly ready to emerge. By placing them in a warm temperature they matured, but did not emerge, but I successfully liberated two examples from which my drawings were made. Subsequently Prof. Henslow kindly informed me that the specimens were submitted to the Council by Mr. Odell, of Stanmore, Middlesex, and that the orchid is a native of Cochin China, but no information could be given as to where this plant originally came from. Presumably, therefore, it had been under cultivation for some time, and the probability is that it was not a recently-imported plant.

Seeing that the male is completely boxed up in its puparium, the wonder is how it manages to effect its escape. I have made a most careful examination of the structure, and have failed to find any trace of a slit or opening in any part of it. One can only surmise, therefore, that the insect liberates itself by breaking away a portion of the ventral part of the puparium, which is at that point extremely thin, and thus escapes from beneath its otherwise comparatively strong domicile.

*Distribution.*—Occasionally met with in Europe under glass, but apparently unrecorded from the open air in the South. It is recorded also from Réunion (Signoret), Ceylon (Green), Brazil (Hempel, Cockerell), British Guiana (McIntire), is common in the West Indies, and Mr. Cockerell has recorded it as introduced into Central America. It has been found on a number of plants, and is apparently a general feeder.

## Explanation of the Plates.

Pl. XLIII, fig. 1.—Female insects, natural size, *in situ* on leaf of chrysanthemum.

Fig. 2.—Old adult female, with star-shaped test or cereous covering (dorsal). × 25.

Fig. 3.—Another example with the three anterior arms imperfect (semi-profile). × 25.

Fig. 4.—Adult female denuded of cereous test (dorsal). × 30.

Fig. 5.—Cephalic extremity of adult female, showing (*a*) the distinct articulation; (*b*) the stigmatic area, antennæ, rostrum, and anterior pair of legs (ventral). × 90.

Figs. 6, 6*a*.—Antennæ of old adult female. × 300.

Fig. 7.—Posterior leg of old adult female. × 300.

Fig. 7*a*.—Tarsus and claw of adult female. × 600.

Fig. 8.—Anterior leg of old adult female. × 300.

Fig. 9.—Anal lobe of old adult female. × 300.

Fig. 10.—Anal ring of old adult female (extended). × 140.

Fig. 11.—Female larva: third stage of cereous test. × 25.

Fig. 12.—Spiracle of adult female. × 300.

Pl. XLIV, fig. 1.—Male (extracted from puparium). × 35.

Fig. 2.—Terminal joint of male antenna. × 300.

Fig. 3.—Leg of the male. × 70.

Fig. 4.—Tarsus and claw of the male. × 300.

Fig. 5.—Under side of the head of the male. × 100.

Fig. 6.—Upper side of ditto. × 100.

Fig. 7.—Portion of the dermis of the genæ of the male, showing reticulation. × 600.

Fig. 8.—Terminal segment of male, with genital armature, and penis protruding at extremity. × 70.

Fig. 9.—Portion of hind margin of wing of male. × 600.

Fig. 10.—Empty puparium of male (dorsal). × 25.
Fig. 11.—Puparium of male with portions broken away, revealing the imago within (ventral). × 25.
Fig. 12.—Female larva (first stage of test). × 25.
Fig. 13.—The same in a more advanced stage. × 25.
Fig. 14.—Male puparia, natural size, *in situ* on leaf of *Cypripedium*.

## Genus Pulvinaria (Targioni-Tozzetti).

Adult females naked; ovisac secreted at period of parturition, *not enveloping* the insect.

Puparium of male inseparable from the puparia of *Lecanium*. This genus comes very near to *Lecanium*, and is only separable from it by the formation of a cottony ovisac below and behind the posterior extremity of the body of the adult female at the period of parturition. In typical forms, such as *P. vitis*, Linn. (Pl. XLV, fig. 1), the ovisac takes the form of a pad, upon which the body of the female *rests*, with the exception of the cephalic extremity, which remains firmly attached to the food-plant (Pl. XLV, fig. 1*a*). In such forms as *P. floccifera*, West. (Pl. XLVIII, fig. 1), the ovisac is very elongate, being from five to eight times the length of the body of the female.

All the stages of the male, including the glassy puparium, as well as those of the female *up to the time of parturition*, are inseparable from those of *Lecanium*, so that in the absence of the ovisac it is quite impossible to fix this otherwise conspicuous genus.

### Synopsis of Species.

**A.** Ovisac short, forming a large pad partly beneath the posterior extremity of the adult female.
(1) . . . VITIS and var. RIBESIÆ.

**B.** Ovisac elongate, extending considerably beyond the body of the female.

*a*. Stigmatic spines much shorter than marginal hairs.

(II) . . . MESEMBRYANTHEMI.

*b*. Stigmatic spines longer than marginal hairs.

(III) . . . . FLOCCIFERA.

## PULVINARIA VITIS (Linnæus).

(Pl. XLV, figs. 1–8; Pl. XLIX, figs. 8–10.)

*Coccus vitis*, Linnæus; Syst. Nat., ii, 741, 16 (1735).
*? Coccus betulæ*, Linnæus; Faun. Suec., 1017 (1746); Syst. Nat., 740, 7 (1767).
*? Coccus carpini*, Linnæus; Syst. Nat., 740, 8 (1736); Id. Faun. Suecia, 1018 (1746).
*Coccus oxyacanthæ*, Linnæus; Syst. Nat., ii, 742, 21.
*? Coccus fagi* (Hardy), Signoret; Essai, p. 212 (1872).
*Pulvinaria betulæ* (Linnæus), Signoret; Essai, p. 207 (1872).
*Pulvinaria salicis* (Bouché), Signoret; Essai, p. 220 (1872).
*? Pulvinaria populi*, Signoret; Essai, p. 218.
*Pulvinaria persicæ*, Newstead; Ent. Mo. Mag., s.s., vol. iii, p. 142, figs. 3, 3 *a* (1892).

Female at period of parturition (Pl. XLV, fig. 1) more or less cordate, narrowest in front, posterior extremity emarginate, anal cleft deep; transversely wrinkled and punctate; dorsum slightly ridged, and where the transverse wrinkles are deepest they often form conspicuous projections. Colour pale to dark chestnut-brown, with a median line of pale ochreous or brownish red. At the completion of the ovisac the extremities of the body curve upwards and inwards, the cephalic area only remaining attached to the food-plant

(Pl. XLV, fig. 1*a*). So much is the body wrinkled at this stage that the dermis has often the appearance of being deeply folded. After parturition the colour changes to a uniform pale or dark chestnut-brown, and the dermis is slightly shining. Antennæ (Pl. XLV, figs. 2–4) normally of eight joints, but there are sometimes only seven (fig. 4). Formula 3, 4, 5, 2, 8, 1 (6, 7), or (3, 5), (2, 4), (6, 7), 8, 1. In all the specimens the second joint possesses a very long hair, and there is a slightly shorter one on the fifth joint, and on the terminal one are five or six. Legs ordinary; digitules to tarsus simple, those of the claw rather strongly dilated. Loop of rostrum scarcely reaching insertion of intermediate legs; mentum uniarticulate and small. Dermis (Pl. XLV, fig. 5, anal extremity) with numerous ovate or approximately-circular pores, and fine pentagonal tesselations, which usually disappear in boiling caustic potash. Marginal hairs small, slender, and generally curved. Stigmatic channel with minute circular spinnerets; marginal spines in a group of three, of which the centre one is much the longest and very slightly curved. Anal ring (fig. 5*b*) of eight hairs, enveloped, as in the genus *Lecanium*, in a thin and finely striate tube (fig. 5), which partly obscures the hairs of the anal ring within. Anal lobes (figs. 5, 5*a*) with several fine hairs at the apex.

The young adult female exactly resembles a *Lecanium*. Colour, under a lens, ochreous or dark yellow, rendered almost obscure by more or less confluent black spots; dorsum with a median ochreous or dull crimson band; to the naked eye the females appear dark smoky-brown in colour, with a faint olivaceous tinge, but the dorsal band is usually distinct.

Larva (Pl. XLIX, fig. 8) with the antennæ (Pl. XLIX, fig. 9) of six joints; formula (3, 6), 2 (1, 4, 5). Legs (Pl. XLIX, fig. 9) ordinary. Anal ring with six hairs.

*Habitat.—Under glass*, on vines and peaches. I

believe that Curtis ("Ruricola") first recorded this in the 'Gardener's Chronicle,' but I have unfortunately mislaid the record, and cannot therefore give the exact reference. In 1885 Mr. Douglas recorded it from Hereford on vines. I have twice received it from Mr. Bignell, of Stonehouse, Devon, and, judging from the numerous examples on the small branch which was submitted to me, the insects must have caused some injury to the vines. In a few localities in Cheshire the insect is common on the peach, but it is apparently a very local species, and does not appear to have spread much in this county. In a great measure this is probably due to the conspicuous nature of the females, which would at once attract the eye of the horticulturist, and thus lead to its speedy extermination. But when neglected, as I have occasionally known it to be, it spreads very rapidly, and soon covers every mature branch of its food-plant.

*Out of doors* it occurs freely upon hawthorn (*Cratægus oxyacantha*) and sparingly on birch (*Betula alba*), willow (*Salix* sp.), alder (*Alnus glutinosa*), and *Cotoneaster* spp. (chiefly *C. microphylla*).

In Delamere Forest, Cheshire, I have taken on birch a few isolated examples of this species, some of which were exceptionally large specimens, but nearly all were parasitised. The only examples on willow are from the same county. They occurred in one small colony in an osier plantation, on the two-year-old wood, and were so low down the plant as to be covered by the rank grass and other vegetation. Mr. Douglas's examples from alder, taken by him at Lewisham, I believe, also occurred upon branches trailing upon the ground. I have had it sent to me from Birdham, Chichester (Nixon), Doncaster (Dr. Corbett), and on an unidentified plant from near Maidstone (A. O. Walker).

The females are for the most part parthenogenetic. The only male puparia I have seen were sent to me by Mr. Bignell. Unfortunately they were empty, and I am therefore unable to give a description of the male.

I do not anticipate, however, that it would in any way differ from the male of var. *ribesiæ* hereafter described.

I have made a careful examination of a long series —*P. betulæ* (Sign.), *oxyacanthæ*, *salicis*, and *persicæ*— which have hitherto been considered distinct species, and have found them identical with typical *P. vitis* from the vine; and, although I have retained *P. ribesiæ* as a variety, I am not at all sure that it will not hereafter be also placed as a synonym of *P. vitis*. With regard to the *Coccus betulæ* and *C. carpini* of Linnæus, it is quite doubtful whether these are referable or not to the genus *Pulvinaria*. I have therefore placed them together with Hardy's *Coccus fagi* and *Pulvinaria populi*, as doubtful synonyms; but I have little doubt as to the two latter being referable to *P. vitis*.

*Distribution.*—Recorded by various authors from Europe. Fitch has recorded it from the United States of America, but Mr. Cockerell has stated that this requires confirmation.

## Explanation of the Plates.

Pl. XLV, fig. 1.—Female insects, natural size, *in situ* on a branch of the vine.

Fig. 1*a*.—Female insect in profile, showing the tilted position of the insect after parturition; the dotted line indicates the extent of the ovisac. × 1·50.

Figs. 2, 2*a*.—Pair of typical antennæ from adult female (a very large example). × 140.

Fig. 3.—Antenna of adult female (smaller example). × 140.

Fig. 4.—Example of seven-jointed antennæ of adult female. × 140.

Fig. 5.—Abdominal extremity of adult female showing derm-glands, anal lobes, and anal ring. × 70.

Fig. 5*a*.—Anal lobe of adult female. × 250.

Fig. 5*b*.—Anal ring of adult female. × 250.

Fig. 6.—Antenna of young adult female. × 140.
Fig. 7.—Leg of young adult female. × 140.
Fig. 8.—Anal ring of young adult female. × 250.
Pl. XLIX, fig. 8.—Larva after treatment with potash (ventral). × 80.
Fig. 9.—Antenna of the larva. × 300.
Fig. 10.—Leg of the larva. × 300.

### Pulvinaria vitis, var. ribesiæ (Signoret).

(Pl. XLVI, figs. 1–14; Pl. XLVII, figs. 1–7 *c*.)

*Pulvinaria ribesiæ*, Signoret; Essai, p. 219 (1872).
Nec *Pulvinaria ribesiæ*, ♂ only (Signoret), Douglas; Ent. Mo. Mag., s.s., vol. i, p. 240, fig. 3.*

Adult female at period of parturition (Pl. XLVI, fig. 2) slightly farinose, dusky yellow, almost covered with dark brown reticulations which often coalesce and form indefinite transverse lines; median line dusky yellow, sometimes slightly tinged with reddish-brown; underside dusky yellow, or dull orange-yellow. Form and external character of dorsal area as in typical *P. vitis;* but after parturition the females usually change to a dark brown or chocolate-brown colour, sometimes approaching black. Antennæ normally of eight joints (Pl. XLVI, fig. 7), but examples occur sometimes with six or seven joints (Pl. XLVI, figs. 8, 9); normal formula as in *P. vitis*. The legs (Pl. XLVI, fig. 10), the dermis (Pl. XLVI, figs. 5, 6), the mentum (Pl. XLVI, fig. 11), and the stigmatic and marginal spines (Pl. XLVI, fig. 12) are also identical with those of *P. vitis*. Reticulations of dermis (Pl. XLVI, fig. 5) very faint and not often traceable; they are also much interrupted.

Long, 4–8 mm.; wide, 3–5 mm.

* The male there described proved afterwards to be the male of a species of Pseudococcus which was living in company with *Pulvinaria ribesiæ*. This error was subsequently corrected in the 'Ent. Mo. Mag.,' s.s., vol. iii, p. 144.

Female at period of fecundation (third stage) (Pl. XLVI, figs. 13, 14) slightly elongate, and sometimes widened posteriorly. Colour dusky yellow, median line brighter, reticulations dark brown and usually very distinct; underside pale dusky yellow; eye-spots, antennæ, and legs dusky. Antennæ of seven joints, of which the third, fourth, and seventh are longest; formula (3, 4), 7, 2, 1 (5, 6). Legs and rostral filaments as in the adult female.

Long, 2–3 mm.

Male (Pl. XLVII, fig. 7) dusky reddish-crimson, scutellum and ovate space above apodema paler; head, dorsal scute of mesothorax, and apodema blackish-crimson, the last-named the darkest; upper nervure of wing and part of space within it and the costa pale crimson; eyes and ocelli black, shining, the former large and placed immediately above the genæ; the ocelli (Pl. XLVII, fig. 7 *a*) in a single pair on the ventral surface, low down near the articulation with the neck. Genæ very prominent, giving the head a somewhat diamond-shaped outline. Antennæ (Pl. XLVII, fig. 7 *b*) of ten joints, of which the first and second are somewhat rounded, the third claviform, fourth, fifth, and sixth longest, the remaining four similar in character, but shorter; apical joint (Pl. XLVII, fig. 7 *c*) with 5–6 clubbed hairs; and there are numerous simple hairs on all the joints. Near the insertion of the antennæ is a minute blunt spine of angular projection. Legs (Pl. XLVII, fig. 7 *e*) thickly set with hairs, and with one long and one short spiny hair at the tibio-tarsal articulation; digitules to claw and tarsi slightly dilated. Anal segment (Pl. XLVII, fig. 7 *d*) with two large projecting tubercles thickly set with rather long hair; the two caudal setæ, for attachment of the waxy filaments, about half the length of the genital armature; the latter comparatively short, triangular in section, and flattened towards the apex, where it is furnished with minute hairs.

Long, including caudal filaments, 2–3 mm.

Long, without caudal filaments, 1·50–2 mm.

Expanse of wings, 3 mm.

Pupa, final stage (Pl. XLVII, fig. 6), at first dusky yellowish-brown inclining to dull crimson-brown, colour changing with age; in the final stage it somewhat resembles the perfect insect, but is more dusky. Anal segment (Pl. XLVII, fig. 6 *a*) with the anal lobes at the *extremity* of the margin, furnished with one apical hair and several fine short lateral hairs. Genital armature short, triangular; the caudal setæ are not produced, but the secreting glands which surround them are strongly defined. Antennal and leg sheaths clearly articulated, with the respective parts in the adult insect showing through (Pl. XLVII, figs. 6 *b*, 6 *c*).

Pupa, first stage (Pl. XLVII, fig. 5), dusky yellowish-brown, elongate; anterior leg-sheaths not reaching beyond the head. Anal extremity with the lobes converging inwards.

Second-stage male (Pl. XLVII, fig. 2) elongate-ovate, the colour resembling the female of the same stage (Pl. XLVI, figs. 13, 14). Antennæ (Pl. XLVII, fig. 2 *a*) of seven joints, of which the third and seventh are longest; formula 3, 7 (1, 2, 4), 5, 6.

Long, 2–2·25 mm.

Male puparium (Pl. XLVII, figs. 1, 4) opaque, glossy white, highest towards the front; upper carinæ enclosing a narrowly ellipsoidal area attenuated behind; marginal carinæ four in number, two in front and two towards the anal extremity.

Long, 2 mm.

Larvæ pale reddish-yellow, resembling those of various species of *Lecanium*.

*Habitat*.—On the three kinds of cultivated currant, and also on *Ribes sanguineum;* it occurs most freely on *R. nigrum*, to which it is often injurious. It is usually abundant where it occurs, but is apparently local. Miss Ormerod * gives Huddersfield

* 'Reports of Observations of Injurious Insects' for the year 1889, pp. 43–49.

(Mosley and Parkin, from whom I have also frequently received specimens); Macduff, Banffshire, N.B. (Cruikshank); Glenmuick, Ballater, Aberdeenshire (M'Kenzie); Stonehaven, Kincardine (Sim); Edinburgh City; Arbroath; and Berwick-on-Tweed (Norman). It is very common in Cheshire, often occurring in town gardens on wall-trained trees in such numbers as to almost cover the main branches; and I have found it equally common in a garden near Bangor, North Wales. It has been forwarded to me from the neighbourhood of Liverpool (Miss Wood, Dr. Green) and of London (H. J. Turner). Mr. F. V. Theobald* has also found it in abundance in Huntingdonshire.

Mr. Douglas (l. c.) gives *Pyrus aucuparia* as an additional food-plant; but I believe the specimens were not examined microscopically, so that it is doubtful if they were really this variety or typical *P. vitis*.

*Distribution.*—Signoret states that he found the species at Clarmart and Chambery in 1871, and Dr. Goethe records it from the Rhine country.

*Habits.*—The young larvæ, or "lice," as they are sometimes called, begin to hatch early in June, and continue to do so until the end of the first week in July, a period of about twenty-eight days. They are very active for a day or so and disperse over the food-plant, ascending freely to the leaves and young and tender branches, but very rarely indeed fixing themselves in such situations. They almost invariably select the hard, ripened wood of the previous year's growth. On warm, sunny days they begin to hatch as early as 8.30 a.m., and greater numbers are apparently then produced than during the heat of the day. Very little change takes place in the larvæ when they first fix themselves to the food-plant; but in the middle of July they undergo their first moult. The effete skin is cast off at the anal extremity, where it may be seen attached to the bark as a minute, dusky-white object. At the end of the second week in August another moult

* 'Rept. South-Eastern Agr. Coll., Wye,' 1902, pp. 2–4, fig. 1.

takes place in precisely the same manner as before. After this the reticulated markings show clearly (Pl. XLVI, fig. 14), and the first trace of sexual distinction begins to appear. Both males and females are at first identical, but the former eventually assume a more elongate form, and the reticulations become more confluent. These changes give the insect a darker appearance. So soon as the elongated form is attained in the male insect, the puparium is commenced; at first there is only a faint trace of the carinæ (Pl. XLVII, fig. 2), but in a few days it is completed (Pl. XLVII, fig. 3). Under this covering the insect changes to the first pupal stage (Pl. XLVII, fig. 5), finally losing the mouth-organs characteristic of all the previous stages. Presumably, therefore, it takes no further nourishment from the food-plant. Towards the end of August the first pupal skin is moulted and pushed out at the anal extremity of the puparium; the true pupal form is then attained (Pl. XLVII, fig. 6). About seven days later the white caudal filaments of the male are seen to project beyond the puparium; at first they are short, but in the course of a few days they assume their full length, when the tips of the wings may also be seen projecting beyond the puparium. The first males appear during the second week in September; they continue to emerge over a period of twenty-one days, the last hatching as late as the second week in October. In confinement the males become very restless, frequently taking a short, rapid flight, which reminds one more of a gigantic leap. When the insect is about to take flight, the long caudal filaments are carried semi-erect, and the wings are spread out and slightly elevated. I did not observe any of the males take to flight out of doors, except when made to do so by disturbing them with a fine-pointed instrument. After fecundation the males die. About the end of September the females effect their third moult, but on this occasion only the ventral skin is cast off at the anal extremity, remaining as a minute, white, shrivelled object on the

bark until the wind carries it away. After this moult many of the females change their quarters, but the majority remain where they first fixed themselves as young larvæ. Growth takes place immediately after the moult, and by the third week in October the insects attain a length of 3–4 mm. (Pl. XLVI, fig. 1). Their colour then closely resembles that of the bark of the food-plant, and is thus highly protective, so much so that even when the branches are almost covered with coccids the latter are by no means conspicuous. The insects pass the winter in the stage last described, and early in March, if the weather is warm and sunny, the females begin to show signs of growth, and to secrete honey-dew; should the weather change to cold and frost, they again become dormant, as in winter; but they begin to re-eject the secretion when warmer weather again sets in. It is, however, during the last fortnight in April and the first week in May that the greatest amount of honey-dew is expelled. Towards the end of April the females thicken, and the margin of the body formerly fixed to the branch becomes raised from the middle to the posterior extremity, thereby slightly exposing the underside, which presents a dull orange colour (Pl. XLVI, fig. 2, two specimens). At this stage the formation of the ovisac is commenced (Pl. XLVI, fig. 2), but the eggs are not laid in it until the pad-like sac has attained the thickness shown in the illustration. The completion of the sac represents the period of egg-laying; individually this occupies altogether about twenty-one days, but collectively it is continued over a much longer period. The females, during the process of the formation of the ovisac, become gradually tilted up from behind, until, eventually, they are only attached to the branch by the anterior or cephalic margin (Pl. XLV, fig. 1 *a*), which position is maintained for an indefinite period—sometimes for two or three years. Death takes place shortly after the egg-laying period; the body then changes to a chocolate-brown, and

eventually almost to black, and is much wrinkled transversely.

Summarising these observations, we find that there is but one brood in a year. The larvæ hatch in June and the early part of July, the first moult taking place from the middle of July onwards; the second moult is in August, when a sexual difference is first observed. Pupation takes place towards the end of August, the males appearing in September. They then fertilise the females, when the latter moult again for the third time. Hibernation commences shortly afterwards, and the insects remain dormant until the spring. Egg-laying takes place at the end of April and throughout the early part of May. In all probability the periods here set forth may vary slightly according to the season. My observations were made during the years 1899–1902, on a colony established on a large plant of *Ribes sanguineum* trained on a south wall, and in other ways well sheltered from cold winds. The colony was established by attaching to the plant in question a small branch of black currant, tenanted by about twenty females with their ovisacs full of eggs. In due course the larvæ hatched and produced several thousand *fertile* females, but only one male! Thus the majority of the females were parthenogenetic. In the following year the increase from the first lot of females was enormous, and portions of the food-plant were at times covered by millions of young larvæ, thousands of which perished through want of space on the seasoned wood; here and there a few examples fixed themselves upon the young and tender shoots, or more rarely upon the leaves, but none reached the first moult on the latter, and very few completed a full life on the former. The colony which survived on the seasoned wood practically covered every available portion of it.

The second generation under observation produced a large number of males, but there was a great preponderance of females. At that period (1900) the colony was in its most flourishing condition, and every

branch of the food-plant was glistening white with their ovisacs.

With regard to the males, I noted one remarkable fact—they were almost exclusively confined to those branches which harboured the old dead females and their ovisacs of the previous year; only a very few male puparia occurred upon branches which had not been previously tenanted by the females. The wood which was tenanted by the previous generation was older, and there was naturally less space upon it for their successors; but whether this fact, together with the greatly overcrowded condition of the individuals, had any effect upon the production of males, I am unable to say, but, taking all the facts into consideration, is it not probable that it had? In the numerous colonies of this species which have come under my observation, I only once previously met with the male puparia, and that was under precisely similar conditions. The plant had become overcrowded, and the male puparia were fixed chiefly on the old wood among the dead females of the preceding generation.

*Honey-dew.*—The greatest amount of this secretion was expelled towards the end of April and onwards; and, from what I could gather by experiment, between the hours of 8.30 a.m. and 10 a.m., and again between 4 p.m. and 6 p.m., but the process continued throughout the day, as well as during the night. By fixing a piece of grease-proof paper beneath a branch occupied by 100 females, I was able to ascertain exactly how many drops of secretion were expelled at any time of the day during fine weather, and also the distance to which it was ejected. On one occasion I found that the 100 females had expelled 225 drops between 8.30 a.m. and 10 a.m., and 97 drops between 5 p.m. and 5.30 p.m. on the same day. Judging from repeated experiments, I estimate that the 100 females, during a day of *twelve hours* (6 a.m. to 6 p.m.), expelled about 800 drops of secretion, which is equal to eight drops per insect per day. These figures do not include

the drops of secretion produced between 6 p.m. and 6 a.m., during which hours I was unable to get any satisfactory results, as the drops of secretion invariably coalesced during the night; but if we allow for the night about half the quantity secreted during the day,

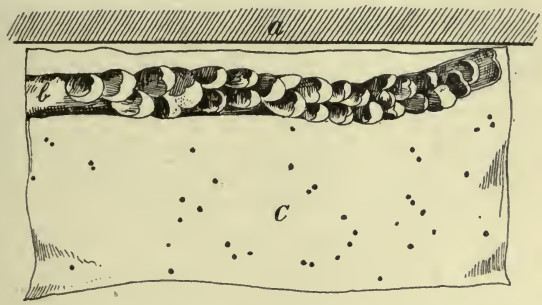



FIG. 2.—*Pulvinaria ribesiæ*, Sign. Illustrating secretion of honey-dew by adult females: *a*, section of wall; *b*, branch with insects; *c*, paper placed beneath branch to intercept and hold falling fluid. The dots on *c* represent the distances to which the honey-dew was projected. All actual size.

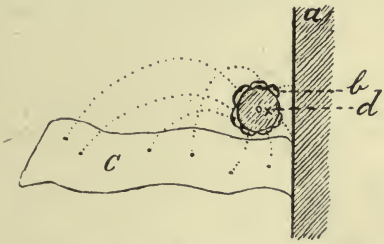



FIG. 3.—*Pulvinaria ribesiæ*, Sign. Diagram illustrating secretion of honey-dew by adult females: *a*, section of wall; *b*, insects; *c*, paper placed beneath branch to intercept and hold the falling fluid; *d*, section of branch. The curved dotted lines indicate the probable course taken by the fluid. The dots upon the paper indicate the actual size of each single drop of the fluid and the position to which it was ejected. Section of branch, and paper, actual size.

we have an aggregate in round figures of 1200 drops of secretion per day. Basing this calculation upon the supposition that each of the 100 coccids elaborated the same amount for a period of twenty-one days, which in my experience is approximately correct, then 100

coccids would produce 25,200 drops of secretion. It is no small wonder, therefore, that the foliage of such coccid-infested plants should speedily become covered with honey-dew.

The maximum distance to which I found the secretion thrown was 21 mm. (see figs. 2, 3 *c* in text), and the average diameter of a single drop of the secretion on the paper was ·75 mm. Its consistency is like that of good honey, and it spreads very slowly in dry weather, but is apparently more mobile at night.

Many insects were attracted by the honey-dew, including *Bombus* spp., *Anthophora pilipes*, *Apis mellifica*, *Vespa* spp., and many species of Diptera.

*The Non-Polyphagous Habits of the Females.*—Seeing that *P. vitis* affects plants belonging to the Viniferæ, Rosaceæ, Salicineæ, and Betulaceæ, the thought occurred to me that possibly the var. *ribesiæ* might be induced to feed upon other plants than *Ribes sanguineum*, *R. nigrum*, and *R. rubrum*. I therefore transferred a number of ovisacs, each containing at least 1000 ova, to the following plants:—

Ranunculaceæ.

1. *Clematis vitalba*, L. (5 ovisacs.)

Cupuliferæ.

2. Oak (*Quercus robur*). (12 ovisacs.)

Berberideæ.

3. Barberry (*Berberis vulgaris*). (5 ovisacs.)

Leguminosæ.

4. Gorse (*Ulex europæus*). (5 ovisacs.)

Rosaceæ.

5. Damson (*Prunus* sp.). (4 ovisacs.)
6. Pear (*Pyrus communis*). (15 ovisacs.)
7. Apple (*Pyrus malus*). (13 ovisacs.)
8. Bramble (*Rubus fruticosus*). (5 ovisacs.)

9. Rose (*Rosa* sp.). (5 ovisacs.)
10. Hawthorn (*Cratægus oxyacantha*). (9 ovisacs.)

GROSSULARIACEÆ.

11. Gooseberry (*Ribes grossularia*). (6 ovisacs.)

LABIATÆ.

12. Lavender (*Lavandula spica*). (5 ovisacs.)
13. Cultivated thyme (*Thymus vulgaris*). (8 ovisacs.)

OLEINÆ.

14. Privet (*Ligustrum vulgare*). (15 ovisacs.)
15. Lilac (*Syringa vulgaris*). (7 ovisacs.)

RHODORACEÆ.

16. *Rhododendron ponticum*. (8 ovisacs.)

TILIACEÆ.

17. Lime (*Tilia* sp.). (13 ovisacs.)

CONIFERÆ.

18. Spruce Fir (*Picea excelsa*). (15 ovisacs.)
19. Irish Yew (*Taxus baccata*, var. *fastigiata*, Lindl.). (6 ovisacs.)

SALICINEÆ.

20. Willow (*Salix* sp.). (19 ovisacs.)

In due course the larvæ hatched successfully, and could be seen actively disporting themselves over the foliage and branches of the various plants; those on the gooseberry survived the first moult, but all the rest died in the course of a day or so. Naturally one did not expect the larvæ to live on many of the plants enumerated in the list, but I was rather surprised to find that they did not establish themselves on the hawthorn or willow, seeing that these are the food-plants of *P. vitis*. The result would, no doubt, have been infinitely more interesting had I conducted the experiments on all the known food-plants of *P. vitis*, but they were, unfortunately, not available at the time,

and the matter must therefore stand over for future investigation.

*Natural Enemies.*—When the colony under observation was first established, the insects were quite free from internal parasites. But the second generation became infested by chalcidid parasites, which increased in the third generation to such an enormous extent that quite 50 per cent. of the coccids were destroyed by them. The few coccids which now remain (1902) are apparently all parasitised, and it is very doubtful if any of them will produce ova next season; and, moreover, if the few remaining coccids are not protected from the birds during the winter months, the colony will be completely exterminated.

On the 17th of October, 1901, after long and careful watching, I observed, for the first time, one of the chalcidid parasites in the act of laying its eggs in the body of a coccid. When first seen the parasite was running swiftly from place to place, evidently searching for a suitable host; its antennæ were bent downwards almost at right angles to the long scape forming their basal half, and were moved up and down rapidly and alternately, the tips each time touching the path of the insect as it progressed. Many coccids were examined, and when a suitable one was found the parasite turned its head towards the anterior extremity of the coccid, and, resting with all its feet upon the body of the latter, inserted its ovipositor into the centre of the thoracic area; it then slowly moved its abdomen up and down, and apparently laid its eggs in the puncture; the parasite then withdrew its ovipositor, and, turning round abruptly, feeling its way again with its antennæ, seized with its jaws the lips of the wound made by its ovipositor, and distinctly closed them upon it and apparently pressed the edges together; finally, it passed the palpi over the wound, and then left the coccid to its fate. I subsequently saw the process of ovipositing repeated by three different individuals, each one acting precisely the same as the first. So far, I

have been unable to identify the parasite, and have now forwarded examples to Dr. Howard, of Washington, U.S.A. Should he favour me with its name, I shall have pleasure in calling attention to it in the Appendix.

At page 40 in the first volume of this work I gave a record of the marsh tit feeding upon this coccid in October, 1901. In 1902 a number of sunflowers ripened in my garden, and the seeds attracted an unusual number of titmice; the species present were the great tit (*Parus major*), the blue tit (*P. cæruleus*), the marsh tit (*P. palustris*), and the cole tit (*P. ater*). By careful watching, I found that all four species frequently visited the colony of *Pulvinaria ribesiæ*, and in four days had eaten quite a number of them. A double thickness of fish-netting was then placed over the tree in order to protect the coccids which were left.

## Explanation of the Plates.

### Female.

Pl. XLVI, fig. 1.—Females natural size *in situ* on branch of *Ribes sanguineum*, as seen in March after hibernation.

Fig. 2.—Females natural size *in situ* on *R. sanguineum*, as seen early in May. Two examples have commenced the formation of the ovisac.

Fig. 3.—Female insects natural size after the completion of the ovisac.

Fig. 4.—Adult female after treatment with potash (ventral). × 15.

Fig. 5.—Portion of dermis showing large cells and reticulation (dorsal). × 250.

Fig. 6.—Portion of ventral dermis showing minute tubular spinnerets. × 600.

Fig. 7.—Pair of normal eight-jointed antennæ from an adult female. × 140.

Fig. 8.—Abnormal seven-jointed antenna of adult female. × 140.

Fig. 9.—Abnormal six-jointed antenna of adult female. × 140.
Fig. 10.—Leg of the adult female. × 140.
Fig. 11.—Mentum of adult female shown without the filaments and basal attachments. × 140.
Fig. 12.—Stigmatic and marginal spines. × 300.
Fig. 13.—Female at period of fecundation (ventral). × 12.
Fig. 14.—The same showing characteristic reticulation (dorsal). × 12.

## Male.

Pl. XLVII, fig. 1.—Puparia of the male with caudal filaments of the perfect insect projecting at the posterior extremity. The two coloured examples represent the male before formation of puparium, slightly enlarged.
Fig. 2.—Second stage of the male larva. × 12.
Fig. 2 *a*.—Antenna of second-stage male. × 140.
Fig. 2 *b*.—Leg of the second-stage male. × 140.
Fig. 3.—A more advanced stage of the male larva, showing the puparium almost completed. × 12.
Fig. 4.—Puparium of the male after the escape of the insect. × 20.
Fig. 5.—Pupa, first stage. × 20.
Fig. 6.—Pupa, final stage. × 20.
Fig. 6 *a*.—Anal segment of true pupa showing lobes and rudimentary genital armature. × 100.
Fig. 6 *b*.—Antennal sheath of pupa revealing the antenna of the perfect male within. × 100.
Fig. 6 *c*.—Leg-sheath of the same revealing the leg of the perfect male within. × 100.
Fig. 7.—Male. × 100.
Fig. 7 *a*.—Underside of the head of the male. × 100.
Fig. 7 *b*.—Antenna of the male. × 100.
Fig. 7 *c*.—Apical joint of the same. × 250.
Fig. 7 *d*.—Anal segment of the male with genital armature, etc. × 100.

## Pulvinaria mesembryanthemi (Vallot).

(Pl. XLIX, figs. 1–7.)

*Coccus mesembryanthemi*, Vallot; Bull. de Férussac, xxii, p. 469 (1830).

*Calypticus mesembrianthemi*, Costa; Ann. d. Acad. Asp. Nat. Naples, 273 (1844).

*Pulvinaria biplicata*, Targ.-Tozz.; Catl., p. 34 (1868).

*Pulvinaria mesembrianthemi*, Signoret; Essai, p. 215.

*Pulvinaria mesembryanthemi*, Douglas; Ent. Mo. Mag., vol. xxiv, p. 24 (1887).

Adult female (fig. 1) "ovate, yellowish brown, slightly convex, with three or four strong corrugations across the middle, often, however, in the most advanced condition; the dry scale (♀) is also contorted or bent backwards. Underneath, and projecting posteriorly, is a large, long, white ovisac, smooth above, but otherwise composed of loose, tangled, cottony filaments, among which are the yellow eggs and larvæ" (Douglas, l. c.). Antennæ (fig. 2) strong, of eight joints; formula 3 (2, 4) 1, 8 (5, 6, 7); all the hairs unusually short. Legs (fig. 3) strong; digitules to claw very broad and strongly dilated at apex; those of the tarsus ordinary. Dermis above (fig. 5) with the oval pores widely separated; ventral dermis (fig. 6) with numerous, extremely short, tubular spinnerets, and others, very long and widely separated, with the inner capitate extremity shaped like the ungulate hoof of a deer. Anal cleft rather deep; lobes normal. Marginal spines (fig. 7) very small, slender, and widely separated; stigmatic spines (fig. 7 *a*) about one third the length of the former. Anal ring with eight hairs, of which one pair is shorter than the rest. On the ventral surface, anterior to the region of the anal lobes, are two pairs

of strong hairs—the first pair very short, the second three times as long as the first. There are generally three similar hairs at the base of the antennæ, extending in a single series towards the median line, each successively longer than the first, which is quite close to the base of the antennæ.

Mr. Douglas gives the measurements of the living examples as: Length of scale (♀), 4–5; breadth, 3–3·5 mm.

After boiling in potash I find that they measure: Long, 3·50–4·25 mm.; wide, 2·50–3·50 mm.

"In the young stages and up to the time of the formation of the ovisac, the entire insect is delicate pale green, and the scale (♀) is smooth; the colour becomes gradually brown, and the transverse folds then also first appear, developing as the scales become dry." (Douglas, l. c.)

*Habitat.*—"On a small piece of *Mesembryanthemum* imported from Spain, received from Dr. W. H. Lowe, Wimbledon, in April, was a numerous colony of this species in all stages of existence" (Douglas, l. c.). My examples were from Mr. Douglas' collection, and were part of the same lot of insects; they were, however, detached from their ovisacs, and I am therefore unable to compare the latter with those of *P. floccifera;* but, judging from a figure of the adult female given by Berlese and Leonardi,* it is only about twice the length of the insect, or approximately twice as long as the ovisac of *P. vitis.*

*Distribution.*—Apparently a native of Southern Europe, but not a very common species.

## Explanation of the Plate.

Pl. XLIX, fig. 1.—Adult female after treatment with potash (ventral). × 15.

Fig. 2.—Antennæ of adult female. × 140.

Fig. 3.—Leg of the adult female. × 140.

* 'Annali di Agricoltura,' 1898, p. 50, figs. 23 *a*, 24 *a*.

Fig. 4.—Dorsal spine of adult female. × 140.
Fig. 5.—Dermis of adult female (dorsal). × 600.
Fig. 6.—Dermis of adult female (ventral). × 600.
Fig. 7.—Marginal spines of adult female. × 300.
Fig. 7 *a*.—Stigmatic spines of adult female. × 300.

## Pulvinaria floccifera (Westwood).

(Pl. XLVIII, figs. 1–10.)

*Coccus flocciferus*, Westwood; Gardener's Chronicle, 1870, p. 308, fig. 52.
*Pulvinaria camellicola*, Signoret; Essai, p. 208, pl. ii, figs. 4 and 6 (1872).
*Pulvinaria phaiæ* (Lull), King; Entomological News, 1891, p. 311.
*Pulvinaria brassiæ* (Ckll.), King; *l. c.*

Adult female in life (fig. 2) distinctly cordate, but becoming much wrinkled after gestation. Colour pale yellow, lower half of body mottled with reddish brown, or brightly ochreous; after parturition the colour usually changes to dusky ochreous. After treatment with potash (fig. 3) the form is more ovate. Antennæ (fig. 6) usually of eight joints, but some examples occur with only seven (fig. 6 *a*). Formula of eight-jointed antenna 3, 2, 4, 5, 8 (1, 6, 7), of which the first four are the longest, and the sixth and seventh joints the shortest; there are one long and one short hair on the second and fifth, one shorter one on the sixth and seventh, and several on the apical joint. Legs (fig. 7) about one third longer than the antennæ, very strong, with two or three short hairs on the coxa, a very long one on the trochanter, and several short ones on the femur, tibia, and tarsus; digitules to claw very long, broad, and dilated at apex; those of the tarsus scarcely longer, and faintly clubbed. Marginal hairs (fig. 8) simple and very slender; stigmatic spines (fig. 8) arranged in a triangle; the two inner ones, short, broad, and obtuse, are about half the length of

the outer one, which is curved towards the tip and usually pointed. Dermis above (fig. 4) with numerous irregular ovate pores or glands; spinnerets on ventral dermis (fig. 5) long and tubular, resembling those in the Diaspinæ. Dorsum immediately above anal lobes, with three pairs of long, equidistant hairs, and there is a group of shorter ones in the centre of the cephalic area. Rostral loop not extending beyond insertion of intermediate legs.

Long, 2–3 mm.; wide, 1·50–2 mm.

Ovisac of adult female (figs. 1, 2) very elongate, from five to eight times the length of the adult insect, straight or curved; sometimes examples cross each other, and when overcrowded form irregular masses of white flocculent matter on the branches (fig. 1 *a*) and leaves of the food-plant.

Long, 5–11 mm.; wide, 2 mm.

Immature female (fig. 10) pale yellow, eyes piceous, anal lobes reddish-brown, alimentary canal dusky brown, showing through the integument in the form of a long, irregular, narrow loop; underside paler.

Ova pink.

Male.—I have not observed this sex, although I have found the species very abundant in many localities. Mr. Douglas* briefly describes the male and its puparium thus:—"On January 29th last [1886] Mr. Parfitt sent me from a greenhouse at Exeter a leaf of camellia on the underside of which were several yellowish, extremely flat, oval scales, but two of them had a slightly raised brownish line down the middle. They were so like the scales of *Lecanium hesperidum* that I deemed they were that species, which is found on many different plants; and having pinned down the leaf so as to prevent its warping, I put them in a box on one side. Looking at the leaf on February 23rd, I saw that all the scales except two had dried and become loose. Of the two one remained fixed, and underneath was a developed male, dead and adherent

* 'Ent. Mo. Mag.,' vol. xxiii, p. 81 (1886).

to the scale; the other scale had disappeared, and in its place was a white, slightly convex, smooth, shining scale, which, when I attempted to raise it with a needle, broke and disclosed a male imago alive. The head, eyes, antennæ, thorax, legs, and abdomen were wholly yolk-yellow, the antennæ thickly set with short projecting hairs, the two anal filaments snow-white, the broad wings smoke-white, sub-opaque, the costal area and also the adjacent ordinary nerve faintly tinged with pink."

The true character of the male puparium is not at all clearly described; presumably it is of the normal Lecanoid form and glassy.

*Habitat.*—Common in many places, chiefly affecting the camellia, on which it is often quite a pest; but it also lives upon soft-wooded plants in warm houses. Professor Westwood first recorded this species in the 'Gardener's Chronicle' (l. c.), and says: "Although I had nowhere before seen this insect in any English conservatory, I detected it shortly afterwards on camellias in the gardens of my friend Dr. Verborer, at Hooghtlands, near Utrecht, in Holland, where, however, it had not previously attracted attention." Douglas* was the next to record the species in 1885. He gives no localities, and merely says that he had the species from greenhouses. Later (1886) he records the species sent by Mr. Parfitt from Exeter, and also from camellias in Mr. Stainton's greenhouse. Again, in April, 1886, he had the species from "Kew Gardens on *Oncidium papilio* and *Calanthe natalensis*." I have met with it abundantly in many parts of Cheshire and Lancashire; and both Mr. Green and I found it in the Royal Botanic Gardens, Kew. I have also received it from Raby Castle (Brock), London (Bennett-Poë), and Darley Dale (Tomlin).

*Habits.*—In cool houses and conservatories the species is single-brooded, but in warm houses I have found it in various stages at all times of the year, and

* 'Ent. Mo. Mag.,' vol. xxii, p. 159.

there seems to be a succession of broods. When single-brooded the females hibernate through the winter in an immature stage. From the middle of April to May the ovisacs are secreted, the perfect males appearing before this is accomplished. After the completion of the ovisac the female falls away and perishes—a habit, I believe, peculiar to this species.

*Distribution.*—Probably indigenous to Southern Europe, where it occurs in the open air; in other parts of Europe it is found on cultivated plants under glass. Cockerell records it from Ottawa, Canada (also under glass), and from the United States of America, on plants imported from Belgium and Japan; Green gives Calcutta; and Maskell, New Zealand, says: "in the south, chiefly in greenhouses; in the Hutt Valley, Wellington, camellias in the open air are much subject to it."

Signoret (l. c.) describes his *P. camellicola* as possessing sometimes six, sometimes seven joints, attributing the latter characteristic to the male larvæ (? second stage). Having found that adult females of *P. floccifera* possess antennæ with seven or eight joints, I have come to the conclusion that Signoret had abnormal specimens before him when making his diagnosis, and have therefore placed his species as a synonym.

I have already stated that *P. vitis* possesses antennæ with six, seven, or eight joints; it is not surprising, therefore, if *P. floccifera* should present the same amount of variation in the number of antennal joints.

## Explanation of the Plate.

Pl. XLVIII, figs. 1, 1 *a*.—Insects natural size *in situ* on camellia leaf and branch.

Fig. 2.—Adult female and ovisac, the latter with longitudinal and transverse cracks or fissures revealing the pink colour of the eggs within. × 4.

Fig. 3.—Adult female after treatment with potash (ventral). × 20.

Fig. 4.—Dermis of adult female, showing character of derm-cells (dorsal). × 140.
Fig. 5.—Dermis of adult female with tubular spinnerets (ventral). × 600.
Fig. 6.—Normal antenna of adult female. × 140.
Fig. 6*a*.—Abnormal antenna of adult female. × 140.
Fig. 7.—Leg of the adult female. × 140.
Fig. 8.—Marginal hairs and stigmatic spines of adult female. × 300.
Fig. 9.—One of the three pairs of dorsal hairs from abdomen of adult female. × 300.
Fig. 10.—Second-stage female. × 10.

## Genus Lecanium* (Illiger).

Adult females (Pl. LI, fig. 1; Pl. LVI, fig. 1) naked, or rarely faintly farinose, retaining legs and antennæ; form varying from low convex to hemispherical above, becoming hollow beneath at the period of parturition; dermis with simple glands, reticulations, or polygonal cells.

Male puparia (Pl. LII, fig. 11; Pl. LVI, fig. 10) glassy.

This genus is the most extensive and widely spread of the whole family of the Coccidæ, and has from time to time been expanded almost indefinitely to suit the convenience of various authors in order that they might include in it many aberrant forms. The above diagnosis does not, however, embrace any of the characteristics of the degenerate exotic species, which have recently been placed in the following newly-erected genera or sub-genera:—(1) *Akermes* (Cockerell), (2) *Neolecanium* (Parrot), (3) *Mallococcus* (? Cockerell), (4) *Megasaissetia* (Cockerell). In all these the characteristics of the adult females differ materially from those of the typical *Lecanium*.

In the first the antennæ are either quite rudimentary

* *Lecanium*, which dates from 1835, is, by some authors, considered to be preoccupied by *Calypticus*, Costa (*see* Appendix).

or atrophied so as to render the articulations indistinct, the legs being mere colourless rudiments, or entirely absent. Moreover the body of *A. punctatus*, Ckll., is covered with a thin secretion, and that of *A. pinguis*, Maskell, with an oily coat.

In the second the antennæ and legs are also rudimentary or atrophied. *N. imbricatum*, Ckll., one of the species included in this division, is covered with a fragile coat of *glassy* secretion.

In the third the antennæ of the female are as in one and two, but in *M. lanigerus*, Hempel, the body is covered with a mass of secretion.

In the fourth the female is very convex, subglobular, with the antennæ and legs rudimentary.

Not one of the insects included in the foregoing divisions has been found within the British Isles, so that they need not be further discussed in this work. But the genus *Lecanium* has been still further divided into seven or eight subgenera, including the species which have been found in this country. Seeing that I have already referred to the genus as a whole under the old name *Lecanium*, it would, I think, be extremely unwise to adopt any of the subdivisions in this work, especially as many of the characters are extremely trivial and inadequate, and would tend rather to embarrass the student than otherwise. The new names have, therefore, been placed as synonyms under the various species to which they refer.

### Synopsis of Species.

A. *Dermis of females with simple glands or cells, and usually a very delicate reticulation.*

**A.** Adult females more or less flat or low convex, not highly chitinised.

*a.* Form slightly elongate; antennæ of seven joints.
(I) . . . . HESPERIDUM.

*b.* Form very elongate; antennæ of eight joints.
(II) . . . . LONGULUM.

**B.** Adult female highly convex, sometimes hemispherical, and more or less rugose.

(III) . . PERSICÆ and *var.* CORYLI.

**C.** Adult female with a delicate marginal fringe, and usually with a dorsal fusiform swelling. Coxa one third the length of the tibia.

(IV) . . . . CILIATUM.

**D.** Adult females more or less hemispherical, spheroid, or oblate-spheroid.

*a.* Dorsum with conspicuous tubercles; *anal lobes rounded.*

(V) . . . BITUBERCULATUM.

*b.* Dorsum rounded, with two to four short, deep, irregular grooves radiating from the anal cleft; sides of body comparatively smooth. Legs and antennæ short.

(VI) . . . . CAPREÆ.

*c.* Dorsum without grooves; sides of body rugose or wrinkled, with, generally, two lateral carinæ. Antennæ and legs well developed.

(VII) . . . HEMISPHERICUM.

B. *Dermis of females with a very distinct polygonal tesselation.*

**A.** Adult females flat.

*a.* Dermal tesselation very large, and divided into two dorsal, one subdorsal, and one marginal series.

(VIII) . . . . PERFORATUM.

*b.* Dermal tesselation small and irregular.

(IX) . . . . NIGRUM.

**B.** Adult female highly convex, with one longitudinal and two transverse carinæ, forming the letter **H**.

(X) . . . . OLEÆ.

## Lecanium hesperidum (Linnæus).

(Pl. L, figs. 1–10.)

*Coccus hesperidum*, Linnæus; Syst. Nat., ii, 739, 1 (1735).
*Calymnatus hesperidum*, Costa, O. G.; Nuove Osserv., tab. i, fig. 1 (1835).
*Calypticus lævis*, Costa, O. G.; Faun. Ins. Nap. Gallins. (1837).
*Lecanium hesperidum*, Blanchard; Hist. Nat. Ins. (1840). Signoret; Essai, p. 229 (1873).
*Coccus patellæformis*, Curtis; Gard. Chron., 1843, p. 517, figs. 1–6.
*Calypticus hesperidum*, Lubbock; Proc. Royal Soc., ix, 480 (1858). Fernald; Canad. Ent., 1902, p. 177.
Nec *Coccus laurinus* (Signoret), Boisduval; Essai L'Ent. Hort., p. 353 (1867).
*Chermes lauri* (Bouché), Boisduval; Essai l'Ent. Hort., p. 340, fig. 44 (1867).
*? Lecanium platycerii*, Packard; Injurious Insects, etc., pp. 28, 31 (1870).
*Lecanium lauri*, Signoret; Essai, p. 230 (1873); Douglas, Ent. Mo. Mag., vol. xxv, p. 57; vol. ii, s.s., p. 244 (1891).
*Lecanium alienum*, Douglas; Ent. Mo. Mag., vol. xxiii, p. 77 (1886).
*Lecanium tesselatum*, Douglas (nec Signoret); Ent. Mo. Mag., vol. xxiv, p. 25 (1887).
*Lecanium depressum*, Douglas (nec Signoret); Ent. Mo. Mag., vol. xxiv, p. 27 (1887).
*Chermes aurantii* (Alfonso), Targioni-Tozzetti; Coccin. degli agrumi in Italia, p. 10, figs. A, B (1891).

Female at period of gestation (figs. 2, 3, 10) pale yellow, dull orange-yellow, or ochreous yellow, faintly greenish-

yellow at the margins; immaculate (fig. 3) or irregularly spotted with dark reddish brown or brownish black, the spots frequently forming an irregular network, the meshes of which are much more pronounced in the central and abdominal areas (fig. 10), appearing to the naked eye as two transverse patches or bands. As the insect matures and the period of parturition begins, the reticulations coalesce, the patches or bands unite, and the dorsum becomes wholly dark brown, approaching to black (fig. 4); finally the margins change to a brownish colour (fig. 5), and the insect dies. After death the insect is usually either dusky yellow or pale brown, but the dorsum generally retains its dark colour. Form slightly convex and elongate, narrowed more or less anteriorly, with the cephalic extremity generally curved to one side, rendering the outline of the body much less curved on one side than on the other; but occasionally the curvature of the sides is more or less equal (fig. 5); dorsum usually with a faint keel. After death the margins become irregularly and transversely wrinkled. Antennæ (fig. 6) of seven joints, of which the third, fourth, and seventh are the longest; there is a very long hair on the second, a slightly shorter one on the fourth, and there are several on the terminal joint; formula (3, 4), 7, 2, 1 (5, 6). Legs (fig. 7) slightly longer than the antennæ, with a long hair on the trochanter. Derm-cells (fig. 8) small, ovate, and widely separated. Marginal hairs (fig. 9), either simple or dilated at extremity, and variously serrated.

There is a slight variation in the antennal joints, but not to the marked extent I find in several other species of *Lecanium*.

With regard to the differential structural characters set forth by me in 1891,* in my endeavour to separate *L. lauri* from *L. hesperidum*, I now find that specimens vary *inter se*, and are quite inseparable.

Male.—In his description of *Chermes lauri* (l. c.),

* 'Ent. Mo. Mag.,' vol. ii, s.s., p. 245.

Boisduval briefly describes the sex thus:—"Le mâle décrit par Bouché est aussi d'une couleur rougeâtre. C'est dans les bifurcations des pousses tendres, et sur les jeunes feuilles du *Laurus nobilis*, que ce kermès se fixe." He gives no reference to Bouché's original description, and I am unable to trace it. The only other known reference to the male is given in the 'Comptes rendus des Séances de l'Académie des Sciences' (Paris), No. 7, February 14th, 1887, p. 449, by M. R. Moniez, in an article entitled "Les mâles du *Lecanium hesperidum*, et la parthénogénèse." Mr. J. W. Douglas* has dealt with this article at some length, and as I have not seen M. Moniez's article, I take the liberty of quoting Mr. Douglas's review of it *in extenso*. He says: "The author premises that sexual dimorphism is ordinarily present in the Coccidæ, the males, contrary to the females, being winged and undergoing complete metamorphoses, yet that in many species they are hitherto unknown, although the females are continually reproductive. Among the species having this character, *Lecanium hesperidum* is always cited, and Leydig and Leuckart are specially mentioned among those who have in vain sought for the males. Then he continues:

"'But this species is by no means parthenogenetic; at least, I have found males in abundance in nearly all the numerous females from different localities that I have examined. I have always found each one isolated in an ovarian *cul-de-sac*, those containing males appearing to be mixed with those containing larvæ of the females.'

"The author then states that he observed several stages of development. In the first there are no external organs, the body appearing to be entirely occupied by the 'follicules testiculaires,' as yet not differentiated, the integument very thin. The second stage is distinguished by having five or six folds of the enveloping membrane, which doubtless correspond

* 'Ent. Mo. Mag.,' vol. xxiv, pp. 25—27 (1887).

to the segments; the evolution of the spermatozoids is effected, the testicles are clearly distinguished, compressed by the development of the rudiments of the organs. At the third stage, which represents the perfect insect, all the salient organs which characterise the adult are present. But the young male has no trace of eyes, and its skin remains very tender, strongly contrasting with the chitinous integument and the well-developed eyes of the young females, which are found at the same time in the body of the mother.

"The summary of these observations is thus given:

"'The male of *Lecanium hesperidum*, among all those hitherto known, is therefore characterised by its minute size, the form of the penis, the absence of eyes and wings, the character of the integument, and the development of the spermatozoids before the appearance of members, at a stage which doubtless corresponds to that of pupa.'

"Then follows a statement of the progressive development of the organs, leading to the conclusion that—

"'The organization of the male does not permit a doubt that there is pairing, but I have not been able to decide if it takes place within or without the body of the mother. I could not find a male outside of the mother, not even under her body, but its imperfect condition rather induces me to suppose that the females are fecundated within the maternal organization.

"'If, however, we consider that the spermatozoids are mature in *Lecanium hesperidum* at the time when the males are yet without relative organization, we cannot but think that there is here a transitory state, or even a still lower degree of development, which may be definite in some species of the same family or any other group. We may even conceive that the males may be rudimentary in such a manner that they may be reduced, in the body of the mother, to sexual elements, and thus there may be produced there a

kind of false hermaphroditism; they might even be represented in the lowest degree by undifferentiated elements, but which, nevertheless, come into connection with the ovules; it may thus happen that the so-called *pseudova* may be identical, in their evolution, with ordinary eggs, and, as in the known hypothesis in connection with agamic Aphides, that the development of the ovules was determined by the hermaphroditism of the females. Be this as it may, as the males escape observation in every case, one cannot fail to infer that parthenogenesis or pedogenesis, which is a form of it, exists. In fine, we conceive that these reduced males may be able, in certain seasons and under certain influences, in consequence of a more retarded evolution of the genital products, to acquire a perfect development and exhibit normal characteristics.

" 'It appears possible to apply these considerations, until there is proof to the contrary, to the various parthenogenetic animals, with the exception, perhaps, of certain Hymenoptera among which the phenomena are more complicated. Parthenogenesis constitutes a peculiar fact which hitherto has not received sufficient explanation, and it may be that, like many other facts apparently aberrant, it will one day come under the general law of sexual reproduction.'

" The discovery of the male of *Lecanium hesperidum*, although the mode of action or influence of this sex has yet to be elucidated, is of itself of very great interest, and in the inferences and suggestions arising from it, with respect to the recondite subject of parthenogenesis in general, has a significance and importance not exceeded by any revelation of modern science."

I cannot help thinking that M. Moniez was mistaken in his identity of the unborn males of *Lecanium hesperidum*, and that what he actually saw were the immature males of one of the Chalcidid parasites which universally infest the females of this species.

Bouché's description of the male of *L. hesperidum* unfortunately leaves much to be desired, and as he gives no structural details it is of no scientific value.

Through the instrumentality of my friend Mr. Thomas Shepheard, of Bournemouth, I have been fortunate in discovering both the second-stage male and the male puparium of *L. hesperidum*, which proves beyond all doubt that the metamorphoses of the male of this species are normal in every essential, and resemble those of other species of the genus. I append below a description of both stages.

Unfortunately I was unable to rear the perfect male, but, judging from the character of the puparium,

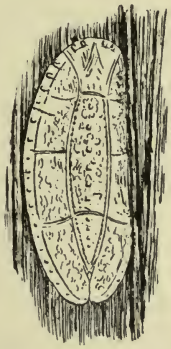


Fig. 4.—Male puparium of *Lecanium hesperidum*, Linn., × 15.

I presume it would not differ materially from that of any other known species.

Second-stage male normal, resembling the immature female (fig. 2 *a*), but more elongate, darker in colour, and the reticulations less distinct.

Puparium of the male (fig. 4 in text) glassy; space within the coronet convex, with a central series of granular projections; lateral carinæ faintly indicated, anterior pair curved outwards, second pair a little posterior to the spiracular channels and not extending to the margins, third pair about midway between the former and the posterior extremity;

margins broadly flattened, with minute equidistant projections; inner margins of carinæ forming the coronet regularly punctate. The foregoing description was made from four examples found among a colony of females on a small date-palm (*Phœnix dactylifera*) sent to me from Bournemouth, 18th February, 1902.

*Habitat.*—In the open air on ivy (*Hedera helix* and *H. amurensis*), sweet bay (*Laurus nobilis*), myrtle (*Myrtus communis*), and holly (*Ilex aquifolium*). Once at Tarporley, Cheshire; common at Corfe Castle, Wareham, Dorset (E. R. Bankes); Budleigh Salterton (Green); East Sheen, Surrey (J. Castle); Kew (Nicholson); Shirley Warren, Southampton (Dr. Sharp); Beaufort Gardens, Exeter (Douglas). *Under glass* it is common and generally distributed throughout the British Isles. The following is a list of the principal food-plants:—Various species of ferns, orange and other plants of the citrus tribe, *Sapindus saponaria* (Douglas), *Bertolonia marchandi*, *Lucuma multiflora*, *Dalbergia lanceolaria* (Green), *Stephanotis*, *Lantana* sp., *Ixora* sp., *Azalea* sp., *Rosa* sp., *Photinia japonica*, *Hibiscus* (Miss Tomlin), *Ficus elastica*, *Eugenia* sp., *Aralia* sp. (Carpenter), *Solanum*, *Abutilon* sp., *Geranium* (Shepheard), *Mangifera indica*, and *Meruta denhami* (Nicholson). *The names in parentheses are those of the collectors.*

*Habits.*—The females are viviparous, and have hitherto been recorded as universally parthenogenetic. The species is much subject to the attacks of a Chalcidid parasite which causes the integument to swell and present a polished surface; the parasitised insect is also of a blackish colour with paler margins.

*Distribution.*—Common in Europe on cultivated plants under glass, and in the open air on bay, ivy, and citrus trees. The Rev. A. E. Eaton found it common in Algeria; it is abundant throughout Cape Colony in South Africa (Lounsbury); it has been recorded from Canada (King); and is apparently common on cultivated plants throughout the United

States of America, where it is also a pest out of doors in climates suitable for the growth of the orange and lemon. Common in the West Indies (Maxwell-Lefroy); Mexico and Chili (Tyler Townsend), Brazil (Hempel); Australia including Tasmania; New Zealand, and the Sandwich Islands. S. I. Kuwana has recently recorded it from Japan on various cultivated plants both under glass and in the open air.

### Explanation of the Plate.

Pl. L, fig. 1.—Insects natural size *in situ*.
Fig. 2.—Female at period of gestation; example from underside of bay leaf. × 10.
Fig. 2*a*.—Younger form from orange showing similar markings. × 10.
Fig. 3.—Female at period of gestation; immaculate form from *underside* of bay leaf. × 10.
Fig. 4.—Female at period of parturition. Early stage, from orange. × 10.
Fig. 5.—A similar example after parturition, from orange. × 10.
Fig. 6.—Antenna of adult female. × 140.
Fig. 7.—Leg of the adult female. × 140.
Fig. 8.—Portion of dorsal dermis of adult female with derm-cells. × 140.
Fig. 9.—Marginal spines of adult female. × 300.
Fig. 10.—Adult female of the form named *alienum* by Douglas. × 10.

### Lecanium hesperidum, var. minimum (Newstead).

*Lecanium minimum*, Newstead; Ent. Mo. Mag., s.s., vol. iii, p. 141, pl. ii, figs. 1, 1 *a*.

Old adult female yellowish-brown; flat, elongate, narrowly rounded in front, surface rugosely punctured with a strong central carina commencing just behind

the black eye-spots and terminating at the anal lobes. The structural characters are like those of the type, from which it differs only in its small size.

Long, ·75–2·50 mm.; wide, ·25–1 mm.

Since publishing my description of this insect in the 'Entomologist's Monthly Magazine' (l. c.) I have prepared a longer series of specimens, and after a most careful examination I have come to the conclusion that *L. minimum* is a very small stunted variety or dwarfed form of *L. hesperidum*.

My examples were under observation for a period of about twelve months, during which time several generations were produced, but none ever exceeded the measurements given above. The food-plants were *Areca* and *Abutilon*, and I have since found it upon palms; all the plants being cultivated under glass.

*Distribution.*—Under date 19th November, 1902, Mr. Cockerell writes as follows:—"You will be interested to hear that I have received *Lecanium minimum*, Newst., from Prof. C. H. T. Townsend, who found it at Colima, Mexico, July 30th, 1902, on a palm. The specimens agree with your description and figures very excellently (specimens 2½ mm. long have produced many larvæ), except that I do not find the tarsus quite so short as you say (anterior legs have tibia 75 $\mu$, tarsus 51 $\mu$)." I am under the impression that Mr. Cockerell has recorded this variety from the United States, but in indexing my papers I have either overlooked the record or I am mistaken.

## Lecanium longulum (Douglas).

(Pl. L, figs. 11–14.)

*Lecanium longulum*, Douglas; Ent. Mo. Mag., vol. xxiv, p. 97 (1887).

*Lecanium angustatum*, Douglas (*nec* Signoret); Ent. Mo. Mag., vol. xxiv, p. 25 (1887).

*? Lecanium chirimoliæ*, Maskell; N. Z. Trans., vol. xxii, p. 137 (1889).
*Calymnatus longulum*, Cockerell; Industrialist, p. 229, April, 1899.

As I have seen only one small colony of this species living in this country, I think it advisable to give Mr. Douglas's original description of the external characters of the adult female. He says (l. c.), "Female dingy pale yellowish-grey; elongate, narrow, ends broadly rounded, side margins slightly curved out, not recurved; surface smooth, transversely arched, longitudinally level, semi-cylindric, not carinate, a band of fairly dark reticulation along the sides [fig. 11], whence, in some examples, faint dark lines radiate to the margin; the disc occupied with a long, pale, clear, oval spot; or in some mature specimens the scale [female] is unicolorous yellow-brown, the dorsal pale spot partly or wholly covered, and on the sides minute pale dots in place of reticulation. Underside all pale, a broad space all round the insect, a conspicuous blackish eye-spot above each antenna." Antennæ (fig. 12) very long and stout, of eight joints, of which the second, third, fourth, and eighth are longest; formula (2, 3, 4, 5, 8), 1, 6, 7. Legs (fig. 14) a little longer than the antennæ; digitules to claw dilated, but more or less suddenly truncate. Derm-cells (fig. 13) like those of *L. hesperidum*, but nearly twice as numerous, which character, together with the very large eight-jointed antennæ, readily separate this species from the latter. Mr. Douglas says that the species is "remarkable for its length, narrowness, and semi-cylindric form." This is perfectly true for those individuals which attach themselves to the comparatively slender stems and branches of the food-plants, but examples which I have seen upon the leaves of the food-plant are, except for their large size, very like *L. hesperidum*.

Long, 4–5·50 mm.; wide, 2–2·25 mm.

*Habitat.*—On stems (rarely on the leaves) of *Acacia catechu*, from Mr. James O'Brien, Harrow; on the same plant, *Anona muricata*, and *Myrica fragifera*, from the Royal Botanic Society's Gardens; and on *Averrhoa carambola* and *Spathophyllum blandum*, from the Royal Gardens, Kew, where, in 1897, Mr. E. E. Green found it on *Cassia fistula*. The only living examples which I have seen were found on the slender stems and leaves of a species of *Euphorbia* at Ince, Cheshire. It is a well-protected species, its colour and form being scarcely distinguishable from the bark of its food-plants. My description of the structural details of the species is made from types kindly supplied by Mr. J. W. Douglas. I find no variation in the number of antennal joints, which is rather remarkable, seeing that Maskell's examples of his *L. chirimoliæ* had but seven joints to the antennæ. An examination of Mr. Douglas's types of *L. angustatum* proves that they are rather small specimens of *L. longulum*. They were sent to Mr. Douglas from the Royal Botanic Society's Gardens, Regent's Park, on *Anthurium scherzerianum*.

*Distribution.*—Its occurrence in England on tender exotic plants points to a tropical or subtropical origin. Mr. Cockerell considers it to be a native of the West Indies, where it is widely distributed and said to be very fairly common. Mr. Maskell records it from the Fiji and Sandwich Islands, Mr. Green from Ceylon, and Mr. King from Massachusetts, U.S.A., under glass.

## Explanation of the Plate.

Pl. L, fig. 11.—Young adult female at period of gestation. × 10.

Fig. 12.—Antenna of adult female. × 140.

Fig. 13.—Portion of dorsal dermis with derm-cells. × 140.

Fig. 14.—Leg of the adult female. × 140.

## LECANIUM PERSICÆ (Geoffroy).

(Pl. LI, figs. 1–8.)

*Chermes persicæ*, Geoffroy; Histoire abrégé des Insectes (1762). Fabricius; Gen. 304 (1766); *id.*, Ent. Syst., 222, 8 (1794); *id.*, Syst. Rhyng. (1803).

*Chermes costatus*, Schrank; Enum. Ins. Aust., 589, pl. x, figs. 11, 12 (1781).

*Coccus amygdali*, Fourcroy; Ins. Par., 1, 228, 5 (1785).

*Coccus persicorum*, Römer; Gener., pl. xi, fig. 9 (1789).

*? Coccus berberidis*, Schrank; Fauna Boïca, ii, 1, 146, 1270 (1801).

*Calypticus lævis*, Costa; Nuove Osservazioni (1835).

*Lecanium vini* (Bouché), Stettin. Ent. Zeitg. Jahrg., 12, p. 112 (1851).

*Lecanium cymbiformis*, Targioni-Tozzetti; Catalogo, 37, 6 (1868).

*Lecanium persicochilense*, Targ.-Tozz.; *idem*, p. 38.

*Lecanium rosarum*, Snellen van Vollenhoven; Tijdschr. Ent., v, 94.

*? Lecanium rugosum*, Signoret; Essai, p. 259, pl. xiii, figs. 5, 5 *a*, 5 *b* (1873).

*? Lecanium wistariæ*, Signoret; Essai, p. 263.

*Lecanium assimile*, Newstead; Ent. Mo. Mag., s.s., vol. iii, p. 141, pl. ii, figs. 2, 2 *a* (1892).

*Lecanium* (*Eulecanium*) *rosarum* (Snell.), King and Reh; Jahrb. der Hamb. Wissen. Anstal., xviii, p. 6 (1900).

* *Coccus patellæformis* (Curtis), Ribaga; Gli Insetti che danneg. il Gelso, p. 8 (1901).

Adult female at period of gestation (fig. 1 *b*) dusky yellow, becoming darker with age; dorsal area usually

* I consider Curtis's insect to be *Lecanium hesperidum* ('Gardener's Chronicle,' 1843, p. 517, figs. 1–6). Many of his specimens were longer and more convex than typical *hesperidum*—characters due to the exigency of the insects on the twigs.

paler, with from eight to nine transverse bands formed of blackish, and more or less distinct, confluent spots; the first anterior band occupying the cephalic area and the second on the thoracic area, which are broadest and most conspicuous, are generally continuous, while those on the abdominal area are much interrupted and rarely continuous on the dorsum; they also become less distinct towards the anal extremity, where they are sometimes represented by a few confluent spots. Eyes brownish-black or black. Form elongate-ovate and highly convex, or rarely short ovate and almost hemispherical.

Adult female at period of parturition (fig. 1 *a*) more or less shining reddish-brown, with the blackish bands of the younger individuals still traceable, and the spots coalesced forming indefinite lines. After parturition the blackish markings entirely disappear, and the colour changes to light reddish-brown or dark castaneous, various shades between these two colours being common; and when the insects are overcrowded they are more or less farinose. Form somewhat resembling the younger insects, but with a narrow, and usually very clearly defined, central carina, having deep and more or less confluent punctures on either side of the dorsum merging into wavy grooves at the sides. Antennæ (figs. 2, 2 *a*) of seven joints, of which the third and fourth are longest, and almost equal in length; the articulation of these joints is sometimes so faint as to be scarcely traceable, and in unstained preparations the two segments appear as one; there is a deep constriction towards the upper portion of the third joint, with three hairs arising from it; when the constriction is very pronounced it appears as a true joint; the central hair on the apical joint is longer than any of the other hairs. Legs (fig. 3) rather slender and slightly longer than the antennæ coxæ much produced beneath and bearing a long hair; digitules to claw slightly dilated, with truncate extremities; those of the tarsi ordinary, short. Dermis

(fig. 4) with a fine, delicate tesselation, generally faintly indicated, and often quite obliterated by maceration in potash; derm-glands of two kinds, one very small, resembling minute circular perforations, the other very large, more or less circular or ovate, and less transparent; these latter are generally surrounded by irregular thickenings of the dermis, and are also intersected by irregular lines or grooves, which together represent the position of the rugosities of the exterior. There is also a group of somewhat larger glands or pores (fig. 4 *a*) extending along the dorsum from the insertion of the anal lobes; these are very transparent, and usually have a central nucleus or pore. All the derm-cells are much more numerous at the margins (fig. 5). Marginal spines (fig. 5) very small, simple, and usually wanting in prepared specimens. Ventral dermis with a few short scattered spines (fig. 8) and several long hairs in the region of the abdominal lobes (fig. 4 *a*). Spiracles (fig. 6) long and slender, and accompanied by a number of circular spinnerets.

Long, 3·50–6·25 mm.; wide, 2–4 mm.; high, 1·75–3 mm.

Larva dusky greenish-yellow, or of a pale reddish colour when fully grown, emitting very long and exceedingly delicate glass-like filaments from both extremities, which appear beautifully iridescent under strong reflected light. When first hatched the larvæ are yellowish or pale red.

Ova white.

Male.—I have never met with examples of either the puparium or the perfect insect. Signoret,* quoting Bouché, describes the male thus:—"Le mâle est d'un brun rouge foncé avec la tête noire; les antennes et les pattes sont jaunâtres; les ailes, blanchâtres, sont bordées antérieurement d'une nuance rose rouge jusqu'à la première nervure. Les poils qui sont sur le dernier article des antennes sont simples.

"Sa longueur est d'une demi-ligne.

* 'Essai,' p. 239.

" Ils paraissent en avril.

" Les larves resemblent aux femelles, mais un peu plus étroites ; au mois d'avril elles commencent à se métamorphoser, le bouclier devient plus pâle et enfin blanchâtre. Sous cet écusson se form la pupe oblongue, d'un brun foncé ; elle a des moignons d'elytres très-courts, d'un brun roux, le thorax fortement convexe et l'abdomen déprimé, avec une ligne médiane élevée. L'étui pénal est saillant."

Ribaga (l. c.) gives a much fuller account of the male, accompanied by an excellent figure, from which I gather that it is of the ordinary type, the special characteristics being the rather large pair of setiferous tubercles on the last abdominal segment but one, and the unusual swollen nature of the last two joints (9, 10) of the antennæ.

*Habitat.*—Chiefly on the peach, nectarine, and rose ; it is rare on the vine, and has once been taken on *Grindelia hirsuta*. In this country it is most abundant under glass, and is often very destructive to the peach and nectarine, and more rarely the vine. It is also found on the above-named plants out of doors, but always on a wall-trained tree, and generally in very small numbers. The following is a list of the localities :—Cheshire, common throughout the county ; Upwell, Cambs. ; Ingoldisthorpe and Barningham Parva, Norfolk ; Witcombe, and Painswick (Watkins), Gloucestershire ; Tring, Herts (Rothschild) ; London district (Douglas and McLachlan) ; Mortlake (Nicholson) ; Dover (Tomlin) ; Isleworth (Cockerell) ; Shirley Warren (Rev. H. S. Gorham) ; Bearsted, Kent (Green) ; Stratford-on-Avon and district (Hodges).

*Habits.*—The most destructive member of the genus, and a very difficult species to eradicate when once established. The eggs are laid about the middle of May (under glass) and the larvæ hatch about the middle of June. They then disport themselves over both branches and leaves (see vol. i, pp. 3, 7), where they generally remain fixed, but individuals may be

seen migrating in autumn; those fixed upon the leaves usually fall away and perish; they hibernate as full-fed larvæ, and are scarcely visible to the naked eye. Moulting takes place in spring, and the insects rapidly approach maturity. The species is very prolific, over 2000 eggs being laid by an average-sized female. The females are agamic in this country, and generally so abroad, Bouché and Ribaga being the only authorities who have observed the males in any stage.

*Distribution.*—Apparently of European origin. It has been recorded from Germany (Cockerell and Reh); France; Hungary (R. Rohant and Dr. Šulc); Italy, on *Corylus* (Berlese); Melbourne, Australia (Maskell); and ? New Zealand, on *Vitis* (Maskell). The food-plants given by Ribaga are: *Vitis vinifera*, *Morus alba*, *M. nigra*, *Prunus persica*, *Amygdalus communis*, *Pyrus malus*, *Prunus domestica*, *P. insititia*, and *Ficus carica*; King and Reh add *Prunus armenica*, *Robinia pseudacacia*, *Spiræa* sp., and *Lonicera* sp., which shows that it is a general feeder, and by no means confined to the peach.

Having examined a long series of insects from the various food-plants in this country, and also some from the continent of Europe, I have come to the conclusion that *L. vini* and *L. rosarum* are inseparable from *L. persicæ*. *L. assimile*, Newstead, must also sink, as I find on re-examination that it is undoubtedly *L. persicæ*. With regard to *L. berberidis*, *L. rugosum*, and *L. wistariæ*, I have little doubt in my own mind but that they also are referable to *L. persicæ*. Dr. Šulc, who has seen Signoret's types, informs me that externally they are inseparable; and hearing also that Signoret's microscopical preparations are extremely poor and in many cases useless, I attach very little importance to his description of the number and relative length of the antennal joints. With badly prepared or even unstained mounts it is often impossible to tell the true articulations from constrictions; it is easy to conceive, therefore, how Signoret may have erred in drawing up his diagnosis of the above insects.

## Explanation of the Plate.

Pl. LI, fig. 1.—Insects natural size *in situ* on peach branch; 1 *b*, at period of gestation; 1 *a*, after parturition.

Figs. 2, 2 *a*.—Antennæ of adult female. × 140.

Fig. 2 *b*.—Antennæ of diseased female. × 140.

Fig. 3.—Leg of adult female. × 140.

Fig. 4.—Dermis from the dorsal region showing faint tesselation and both forms of derm-cells. × 140.

Fig. 4 *a*.—The same showing group of large derm-cells above anal lobes. × 140.

Fig. 5.—Dermis at margin with marginal spines. × 140.

Fig. 6.—Spiracle with spinnerets. × 300.

Fig. 7.—Tubular spinnerets of adult female from ventral dermis near the margins. × 600.

Fig. 8.—Spine from ditto. × 600.

## Lecanium persicæ, var. coryli (Linnæus).

(Pl. LI, figs. 9, 9 *a*–9 *c*, 10.)

*Coccus coryli*, Linn.; Syst. Nat., 740, 10; *id.*, Fauna Suecia (1746).

*? Lecanium ribis*, Fitch; Trans. N. Y. State Agr. Soc., p. 427 (1856).

*Lecanium sarothamni*, Douglas; Ent. Mo. Mag., s.s., vol. ii, p. 65 (1891).

Adult female at period of gestation (fig. 9 *a*) very short ovate, being a little longer than broad, dusky yellow, greenish yellow, or ochreous yellow; dorsum paler, with eight or nine black transverse bands, arranged as in *L. persicæ;* but all the bands are much more distinct than in the type, especially those on the cephalic and thoracic areas.

Adult female after parturition (fig. 9 *b*) usually more or less hemispherical, but quite a number of specimens are elongate-ovate, as in *L. persicæ*. Colour bright reddish-brown or chestnut-brown, with blackish, suffused, transverse lines; the latter are sometimes retained for an indefinite period, but are often entirely absent in cabinet specimens. Sculpture and anatomical characters as in the typical *L. persicæ*.

Long, 3–5 mm.; wide, 2·50–3 mm.

Larva (fig. 10) not differing from the type.

This variety may be recognised from typical *L. persicæ* by its usually short ovate and more or less hemispherical form, and the very distinct transverse black bands. It is also much more constant in size than the type, and the old adults are of a rather brighter reddish-brown.

*Habitat.*—Very common and sometimes injurious to the three kinds of cultivated currant (*Ribes* spp.) and the gooseberry; it is also very common on *Cotoneaster microphylla*, *Ribes sanguineum*, and *Cytisus scoparius*, but rare on raspberry (*Rubus idæus*), *Clematis* spp., *Cratægus oxyacantha*, *C. pyracantha*, and *Philadelphus* sp. Mr. Douglas sent it to me on a species of *Casuaria*, a genus belonging to the Coniferæ, and Mr. Nicholson has found it at the Royal Gardens, Kew, on *Wistaria chinensis* and *Neillia* sp. I cannot find that it has been recorded from Scotland or Ireland, but it has a wide distribution in England; and I have found it common in Denbighshire and Flintshire in North Wales.

Since the time of Signoret this coccid has been referred to by nearly all coccidologists as *Lecanium ribis*, Fitch; but as Fitch's description is quite inadequate and his types are apparently lost, it is impossible to say what he had before him.

Dr. Šulc, of Bohemia, who has seen Signoret's examples of *Lecanium coryli*, Linn., informs me that they are identical with Lecania found on *Corylus* and other plants in Bohemia. Dr. Šulc has been good

enough to send me Bohemian examples which I find are identical with those found in this country on *Ribes* spp., etc. Taking these facts into consideration, I have decided to adopt Linnæus's name; at the same time I should have preferred retaining Fitch's, which is undoubtedly the more appropriate of the two.

*Habits.*—Single-brooded as with the type; the larvæ hatch in June (26th June, 1896), and are of a pale yellow colour.

### Explanation of the Plate.

Pl. LI, fig. 9. — Insects natural size *in situ* on currant branch: 9 *a*, females at period of gestation; 9 *b*, females after parturition; 9 *c*, scar or mark of secretion left upon the branch after the removal of the insect.

Fig. 10.—Larva shortly before hibernating, with long, iridescent, glassy filaments. × 20.

## Lecanium ciliatum (Newstead, MS.), Douglas.

(Pl. LII, figs. 1–11.)

*Lecanium ciliatum*,* Douglas; Ent. Mo. Mag., s.s., vol. ii, p. 67, pl. i, figs. 3 *a*–3 *d* (1891).

Adult female after parturition (fig. 1 ♀) ochreous brown or dusky chestnut-brown; parasitised specimens pale ochreous; form varying according to the position of the female on the food-plant; those fixed in a transverse position are often more or less transversely ovate (fig. 2), the breadth being equal to or greater than the length; those fixed in a longitudinal position slightly elongate-ovate; central area with a

* The name *ciliatum* was given by me in my original MS. description of the insect, which was approved by Mr. Douglas, the description in part being embodied in his diagnosis.

highly convex fusiform swelling, more or less shining; posterior end pointed and terminating immediately above the anal cleft, anterior extremity rounded and terminating well within the cephalic margin; central fusiform swelling with two subdorsal rows of large, deep punctures, which take the same contour as the margin of the swelling; margins broad, sloping downwards, low convex, and deeply and irregularly grooved and punctured. Antennæ (figs. 3, 3 *a*) usually with eight joints, but examples occur with only seven; in the former the third joint is slightly the longest, but not much longer than the second; there is a very long hair on the second and fifth joints; the rest are rather short, especially those on the sixth and seventh joints; formula 3, 2, 4, 5, 6, 7 (8, 1); formula of seven-jointed antennæ 3 (2, 4), (5, 6) 7, 1. Legs (figs. 4, 4 *a*) comparatively short; coxa unusually large, being nearly one third of the length of the femur; tibiæ and tarsi gradually dilated towards the tibio-tarsal articulation, giving the legs a peculiar swollen character; the tarsus is also nearly equal in length to the tibia. Marginal secreting spines (fig. 5) long and stout; inner connecting tube long.

Transversely ovate forms, long, 4·50–7 mm.; wide, 5–7 mm.

Ovate forms, long, 6–8 mm.; wide, 4–4·50 mm.; high 3–4·75 mm.

Female at period of fecundation (fig. 2) resembling more or less the form of the old adults; colour ochreous brown, central fusiform swelling with one dorsal and two subdorsal, irregular, converging bands of dark madder-brown, and a series of large spots of the same colour extending along the centre of the broad margins; the whole area of the body studded with a coarse, white, farinose secretion, less dense upon the dark dorsal bands. The hairs of the anal ring are usually covered with secretion, and project beyond the anal lobes as a pencil of pure white wax. Marginal fringe of delicate white filaments, more or

less irregular, but invariably present. The farinose matter on the body, and also the marginal fringe, disappear with age; the former, being very transient, is never found on old adults, whereas portions of the fringe may be retained for a much longer period. Anal lobes orange-yellow.

Second-stage female (fig. 9) slightly elongate-ovate, and narrowed in front; dark madder-brown; with one central and two lateral longitudinal rows of equidistant, irregularly square or rectangular patches of semi-opaque secretion, somewhat glassy in appearance, but of a soft waxy nature; marginal fringe as in the previous stage.

Male (fig. 10) of the ordinary Lecanid form. Dull red or dull crimson; thorax, apodema, and head very dark crimson; legs and antennæ smoky brown, or yellowish-brown; eyes and ocelli black, shining; caudal filaments comparatively stout, and longer than the body and stylus together. Ocelli four in number: two ventral and two dorsal.

Puparium of male (fig. 11) elongate-ovate, sometimes slightly narrowed in front; semi-opaque, glassy white, surface finely rugose or roughened; carinæ distinct; there is a central series of six or seven angular, or more or less cube-shaped, opaque, white excrescences within the coronet, and a similar series, but somewhat smaller and less distinct, extending all round the puparium midway between the coronet and the margin. Fringe glassy and more permanent than that of the female.

In the puparium figured and described by me * there was a double row of submarginal excrescences, a character I now find almost unique, and therefore not typical.

Long, 2·25 mm.; wide, 1 mm.

Larva comparatively large, dark yellow at first, but changing to crimson-brown; antennæ of six joints; first widest, and in length equal to the fourth and

* In the paper by Mr. Douglas, 'Ent. Mo. Mag.,' l. c.

fifth; second shortest, with one long hair; third longest, with two long hairs; fourth and fifth equal, the fourth with one long hair on the under and one on the upper side; fifth with one very long hair; sixth nearly as long as the fourth and fifth, with two long and three or four shorter hairs, the longest arising from the middle of the joint. Tibiæ and tarsi of nearly equal length, the former with several hairs, the latter with two long ones. Anal cleft deep.

The larvæ, which appear a month later than those of *L. capreæ*, are larger than the larvæ of any other species of *Lecanium* which I have seen.

*Habitat.*—On the common oak (*Quercus robur*), chiefly on branches of from three to five years' growth. Mr. Douglas (l. c.) says: "In the third week of June in the years 1887, 1888, and 1889, Mr. G. C. Bignell, of Stonehouse, Devon, sent on each occasion a single example of this very remarkable scale, they being all he could find on an oak (*Quercus robur*) in his locality, and as they had some resemblance to Réaumur's fig. 8, pl. vi (*Pulvinaria lanatus*, Gmel., Sign.), it seemed possible that they might be that species before the development of the ovisac represented in the figure, and so I have waited for more examples. This year (1890) I requested Mr. Newstead to look for such scales, and on July 26th he obtained several on oaks in Delamere Forest, some of them having eggs within them, proving that they were not *Pulvinaria*. . . ." Since the above records were published, I have taken numerous examples of the female in various stages, and many male puparia, and have also been fortunate in rearing the perfect male. Besides Delamere Forest I have also found it in other parts of Cheshire, and at Chislehurst, Kent. It is not, however, by any means a common species, and requires a great deal of searching for, as it almost invariably occurs singly, and often on very large trees.

*Habits.*—The larvæ hatch towards the end of July. At least one moult takes place before winter, and the

insect grows to some extent before hibernating. In spring (March) the female appears as shown at fig. 9, and is then about 3 mm. long, bearing upon its back the singular square-shaped excrescences, which are composed partly of secretion and partly of the effete skin of the previous moult. The latter is not cast off, but splits or divides into squares, and these, as the insect grows, become more and more widely separated, eventually appearing as indicated. In May another moult takes place, the newly-cast skin carrying with it the marginal fringe, and all the old exuviæ and secretion (fig. 8). After the final moult the insect grows somewhat rapidly, and, at the period of fecundation, is as represented in fig. 2.

The males appear in May,* about three days after casting the pupal skin; but the posterior portion of the puparium is not broken away on the emergence of the male, as stated in my description (l. c.). It remains intact; therefore my type must have been accidentally broken. All my puparia were found on thick branches. The females are much sought after by birds in spring, and quite 50 per cent. of them are thus destroyed.

*Distribution.*—Under date 19th November, 1902, Mr. Cockerell writes: "Marchal sends me from France what I recognise as *L. ciliatum*, Douglas. The antennæ are much like *prunastri*, but the scale (♀) is different. In having a broad central boss or scale it resembles the American *L. canadense* and *kansasense*." I have no doubt that Mr. Cockerell's identification is correct, and if so, it is the only record outside the British Isles.

## Explanation of the Plate.

Pl. LII, fig. 1.—Insects natural size *in situ* on portion of oak branch: ♀ = adult female; ♂ = male puparium, with caudal filaments projecting at anal extremity.

Fig. 2.—Female at period of fecundation. × 15.

* 6th May, 1896.

Fig. 3.—Antennæ of adult female (normal). × 140.
Fig. 3 *a*.—Antennæ of adult female (abnormal). × 140.
Fig. 4.—Leg of the adult female (anterior). × 140.
Fig. 4 *a*.—Leg of the adult female (intermediate). × 140.
Fig. 5.—Marginal secreting spines of adult female. × 300.
Fig. 6.—Spiracle and glands of adult female. × 140.
Fig. 7.—Portion of dermis showing polygonal cells. × 300.
Fig. 8.—Immature female in process of moulting, with exuviæ of previous stage (fig. 9) superimposed. × 25.
Fig. 9.—Second-stage female after hibernation. × 25.
Fig. 10.—Male. × 25.
Fig. 11.—Puparium of male. × 15.

## Lecanium bituberculatum (Targioni-Tozzetti).

(Pl. LIII, figs. 1–9.)

*Lecanium bituberculatum*, Targ.-Toz.; Catal. 38, 18 (1868). Signoret; Essai, p. 244, pl. xii, fig. 13. Douglas; Ent. Mo. Mag., vol. xxv, p. 59 (1888). ♂, Newstead; Ent. Mo. Mag., s.s., vol. vii, p. 58 (1896).

*?Lecanium* (*Eulecanium*) *bituberculatum* (Targ.-Toz.), Cockerell and Parrott; Industrialist, 1899, p. 233.

Adult female (figs. 1, 2) broadly ovate, highly convex, and evenly rounded in front, with two pairs of widely-separated subdorsal, shining tubercles, the anterior pair being much the largest, and very conspicuous; the posterior pair, very small, and sometimes only faintly

indicated, are placed immediately behind the former; the body behind the tubercles usually slopes suddenly downwards to the anal cleft; median area between the marginal cleft and the tubercles more or less convex, usually with a deep depression radiating from the anal cleft on either side; margins at the sides with seven or eight equidistant, and more or less irregularly-raised carinæ, the central carina on each side being much the strongest, and usually extending to the large anterior tubercles; margins of anal cleft raised and prominent. Colour chocolate-brown, chestnut-brown, or rarely greyish-brown or greenish-grey, with a varying number of interrupted, transverse, ivory-white lines or bands, the anterior pair of bands being generally continuous on the dorsum, the rest gradually diminishing in length towards the anal cleft, while, in some examples, the white markings preponderate and partly obscure the ground colour; margins between the carinæ broadly greyish, or greyish-green; tubercles blackish-crimson or piceous, and there are one or two pairs of blackish spots in front of the tubercles intersecting the white transverse bands, the anterior pair being usually the larger; these spots are often very slightly raised above the dermis, and, viewed dorsally, appear as minute tubercles. Antennæ (figs. 4, 4*a*) usually of eight joints, but sometimes of seven, and the comparative length of the joints varies; formula (3, 5) (4, 6, 7, 8) 2, 1, or 3 (4, 5, 6, 7, 8), 2, 1; the hairs are rather straight and stiff. Legs (fig. 5) a little longer than the antennæ, and slender; digitules to claw broadly dilated, with the extremities suddenly truncate, those of the claw ordinary. Anal lobes (figs. 6, 6*a*) *rounded*, with several long hairs the apical portion. Spiracles (figs. 7, 7*a*) circular, with inner basal attachment reticulated. Marginal spines (figs. 8, 8*a*) simple, rather slender, and pointed.

Long, 4–6 mm.; wide, 3–4 mm.; high, 2–2·50 mm. Parasitised specimens smaller.

Female at period of fecundation (fig. 3) elongate-ovate, ends equally rounded; colour light red or reddish-

yellow, with four broad transverse bands of yellow on either side of the dorsum; the latter has a central raised keel or carina extending from the anal lobes to the margin in front, and is of a transparent yellowish colour, and somewhat glassy. The four channels leading to the spiracles, strongly indicated above by well-defined carinæ, are situated on the two central bands. Margin with a much interrupted fringe of glassy material. Anal cleft well defined.

Long, 1·50–2 mm.

Male (fig. 9) dark or pale red, or coral-red; apodema and divisions of the thorax darker. Eyes and ocelli black. Legs dusky yellow or reddish. Caudal filaments very slender and more than twice the length of the body.

Male puparium normal, and very like that of *L. capreæ*. I have found it invariably attached to the leaves of the hawthorn.

Ovum pale yellow.

*Habitat.* — On hawthorn (*Cratægus oxyacantha*). Mr. Douglas (l. c.), who first recorded the species in this country, says: "On February 15th last (1888) Mr. E. Parfitt sent from Exeter one, and on March 20th the other of the two scales described above, which he had just found on twigs of hawthorn in a hedge; this is the first time the species is known to have been taken in Britain. On the 4th of April, on a hawthorn hedge at Lee, within a space of two yards, I found twenty-four scales of this species, always on shoots of last year's growth, sometimes singly, at others two or three close together, mostly at the base of a thorn or bud, but they were localised, for I sought in vain for more in other parts of the hedge." In July, 1895, I found a colony of this species at Heacham, Norfolk, and succeeded in rearing the hitherto unknown male. I have also found it plentiful at St. Albans, Tring, and King's Langley, Herts, and sparingly at Orpington, Kent, and Brockworth, near Gloucester. I have received it

from Bearsted, Kent (Green), and Stratford-on-Avon (Hodges).

The species is undoubtedly very local, and although I have searched for it in many parts of Cheshire, and in suitable spots in Yorkshire and the Western Hebrides, I have failed to find it there.

*Distribution.*—Common in Southern Europe. Signoret received it from Targioni-Tozzetti, and records it as plentiful at Florence, Cannes, and Hyères. Dr. Sulc has also found it in Bohemia; and it very probably awaits the hunter in other parts of the Continent.

*Habits.*—The female lays her eggs about the first week in October, and protects them throughout the winter and early spring under her body. The larvæ hatch in May, and both sexes take up their quarters on the leaves of the hawthorn (very few female larvæ fix themselves upon the branches), where they remain until the period of fecundation. The males appear during the month of July (23rd July, 1895; 6th July, 1896). After fecundation the females descend to the branches, and there remain fixed for the rest of their lives. Moulting takes place soon after migration. In August the females assume very much the colour of the bark, and are then broadly ovate and very flat. The most remarkable trait in this species is the minute size of the female at the period of fecundation. In all other species of *Lecanium* known to me, fecundation takes place when the female has attained the maximum size, and is then enormous compared with the size of the male. Another remarkable character is that the adult females retain all their beautiful bright colours and the white markings all through the winter, and the colours do not fade in cabinet specimens for several years, provided that they are taken in the early part of the winter. All the other British species lose their bright colours at the period of parturition.

### Explanation of the Plate.

Pl. LIII, fig. 1.—Insects natural size *in situ* on branch of hawthorn.
Figs. 1 *a a*, 1 *b*.—Parasitised females natural size.
Fig. 2.—Adult female after parturition. × 6.
Fig. 3.—Female at period of fecundation. × 15, and natural size.
Fig. 4.—Antenna of the adult female. × 140.
Fig. 4 *a*.—Another form of the same. × 140.
Fig. 5.—Leg of the adult female. × 140.
Fig. 5 *a*.—Tarsus and claw of the adult female. × 300.
Fig. 6.—Anal lobes of the adult female (dorsal). × 140.
Fig. 6 *a*.—The same (ventral). × 140.
Fig. 7.—Spiracle of the adult female. × 300.
Fig. 7 *a*.—Semi-ventral view of same. × 300.
Figs. 8, 8 *a*.—Marginal spines of the adult female. × 300.
Fig. 9.—Male. × 25.

## Lecanium capreæ (Linnæus).

(Pl. LIV, figs. 1–11.)

*Coccus capreæ*, Linn.; Syst. Nat., II, 741, 14 (1735).
*Lecanium capreæ*, Signoret; Essai, p. 245, pl. xii, fig. 14. Douglas; Ent. Mo. Mag., s.s., vol. iii, p. 278, figs. 1 and 2 (1892).
*? Coccus ulmi*, Linn.; Fauna Suecia, p. 265, No. 1019.
*Lecanium ulmi*, Signoret; Essai, p. 262, pl. xiii, figs. 15, 15 *a*, and 15 *b* (1873). Douglas; Ent. Mo. Mag., vol. xxiii, p. 79 (1886).
*Coccus tiliæ*, Linn.; Syst. Nat., 741, 11.
*Lecanium tiliæ*, Signoret; Essai, p. 261 (1873).
*Chermes quercûs rotundus fuscus*, Geoffr.; Hist. Ins., i, p. 507, 11 (1764). Douglas; l. c.

*Coccus rotundus*, De Geer; Ins., vi (1776), 440, 2, tab. 28, figs. 13, 14, 15.

*Coccus alni*, Modeer; Götheb., i, 23, 17 (1778).

*Lecanium alni*, Douglas; Ent. Mo. Mag., vol. xxiii, p. 80 (1886).

*Lecanium pyri* (Schrank), Goethe; Jahr. des nas. Ver. für Nat., 1884. Douglas; Ent. Mo. Mag., vol. xxiii, p. 28 (1886).

*Chermes quercûs*, Fourcroy (*nec* Linn.); Entom. Paris, i, p. 229, 11 (1785). Douglas; l. c.

*Coccus fuscus*, Gmel.; Syst. Nat., 13th ed., p. 2221, 33 (1788). Douglas; Ent. Mo. Mag., vol. xiv, p. 98.

*Coccus aceris*, Schrank; Fauna Boïca, ii, 1, 147, 1274 (1801).

*Coccus gibber*, Dalman; K. Vet. Ac. Handl., 1825, p. 366, tab. 4, figs. 11, 12. Westwood; Introd. Mod. Class. Ins., ii, p. 445, fig. 118, 18.

*Lecanium gibber*, Signoret; Essai, p. 252, pl. xi, fig. 9; pl. xii, fig. 19.

*Lecanium gibberum*, Douglas; Ent. Mo. Mag., vol. xxiv, p. 101 (1887).

*Lecanium cypræola*, Dalman; Act. Holm., 367, 5, pl. iv, figs. 13–17 (1825). Signoret; Essai, p. 245.

*Coccus æsculi*, Kollar (1848); Sitzungsb. Akad. Wissensch. Wien, i, 15.

*Lecanium salicis*, Bouché; Stet. Ent. Zeit., xii, 111, 2 (1851).

*Calypticus fasciatus*, Costa; Faun. Rég. Nap. Gallinsectes, 14, 6.

*Lecanium genevense*, Targioni-Tozzetti; Catal., 38, 16 (1868).

*Lecanium cerasi*, Goethe; Jahr. des nas. Ver. für Nat., 1884. Douglas; Ent. Mo. Mag., vol. xxiii, p. 28 (1886).

*Lecanium variegatum*, Goethe; Jahr. des nas. Ver. für Nat., 1884. Douglas; Ent. Mo. Mag., vol. xxiii, p. 28 (1886).

*Lecanium distinguendum*, Douglas; Ent. Mo. Mag., s.s., vol. ii, p. 96, pl. i, figs. 4–4 *c* (1891) .
*Lecanium rubi* (Schrank), Douglas; Ent. Mo. Mag., s.s., vol. iii, p. 105, figs. 1, 2 (1892).
*Eulecanium capreæ* (Linn.), King; Canadian Entomologist, p. 314 (? 1901*).

Old adult female after death (figs. 2–4) dusky chestnut-brown, more or less shining. Form spheroid or oblate-spheroid, generally much the highest and evenly rounded in front, the body sloping suddenly from a little behind the middle to the anal extremity, from which radiate four distinct sulcations (fig. 3), usually with deep punctures and wrinkles, but both are sometimes wanting; upper sulcations often irregular and ill-defined (fig. 3 *a*); there is also a well-defined groove just within the margin, which deeply and suddenly constricts the body immediately above its attachment to the branch, a character most strongly marked at the sides and posterior extremity. Examples on slender twigs, more especially those of the elm, are almost invariably spheroid, with little or no attenuation behind. Antennæ (figs. 5–5 *b*) usually of seven joints, but examples occur with both six and eight joints; fig. 5*a* may be taken as a typical example, in which the third and fourth joints are the longest and almost equal, the articulation being in all cases very faint, and when absent the two joints apparently unite and form one long joint, the antennæ then possessing but six joints. Terminal joint with three or four short spine-like curved hairs and several simple hairs. The antenna in fig. 5 *b* is from a parasitised female, and shows a remarkable division of the fourth joint, which may have been produced by the parasites. Legs short and stout, and apparently partly atrophied; the anterior pair (fig. 6) bent inwards at the articulations; tibio-tarsal joint usually broader than the centre

* The separate papers from this magazine sent to me by various authors are, unfortunately, without date or reference to volume.

of the tibia; claw large; digitules all very short, and furnished with small knobs, those of the claw not extending to the tip of the latter, and often very difficult to trace. Marginal spines (fig. 7) long and slender, and generally broken away in the old examples Mentum short, broad, and obtusely rounded, furnished with several fine hairs; filaments forming loop of rostrum a little longer than the antennæ, but when fully expanded they are more than as long again. Dermis with widely separated gland-pits and a very faint irregular polygonal tesselation.

Transverse diameter, 3·50–6 mm.; longitudinal diameter, 5–6·50 mm.; high, 3·50–5 mm. Dwarfed specimens, measuring 2 mm. in diameter and in height, are often met with in overcrowded colonies.

*Parasitised females.*—These are subject to much variation, the following forms being more or less constant.

*a*. (Figs. 4, 4 *a*.) This is the *Lecanium* (*Coccus*) *gibberum* of Dalman, and is characterised by possessing two large mammiform swellings or gibbosities on the subdorsal area. The swellings are very irregular in size, some being scarcely visible, while others are very pronounced; the distance between them is also variable, in some the swellings almost touch and are then generally highly elevated (fig. 4 *a*), in others they are very widely separated, rendering the sides of the body almost horizontal (fig. 4).

β. (Figs. 4 *b*, 4 *c*.) This variety either retains its normal form (figs. 3–3 *c*), or becomes irregularly swollen (fig. 4 *c*), with the dermis abnormally thin and sometimes semi-transparent. On escaping from their host the parasites invariably puncture the dermis, leaving circular perforations (figs. 4 *b*, 4 *c*).

*Female at period of fecundation.*—As there are several well-marked varieties of the insect when in this stage, it may be convenient also to treat of them separately.

*a*. (Fig. 2.) Form more or less resembling that of

the old adult females, but varying according to age; the cephalic area is generally strongly and broadly depressed. Colour varying from dull reddish-crimson to rich dark crimson; cephalic area and the margins of the abdominal area often fuscous with darker wavy lines; dorsal area with transverse, interrupted, ivory-white bands, which coalesce at the median line and sometimes extend almost to the margin at the sides, but they usually terminate before reaching the sub-dorsal area and reappear again towards the margin in broken lines and blotches; there is also a conspicuous, transverse, interrupted band of white crossing the thoracic area, which widens towards the margin; and occasionally there is another very short band in front of it; all the white markings are strongly interrupted by black or crimson-black marks and punctures. As the insect advances to maturity the white bands darken and gradually become fuscous, eventually disappearing entirely. This is the *Lecanium* (*Coccus*) *fuscum* of Gmelin.

β. Form resembling α, or broadly ovate and rather flattened (fig. 2 *b*). Colour dark crimson-black or dark castaneous, paler towards the sides; dorsum with a narrow, longitudinal, suffused band of yellow, and there are from two to four short, broad, transverse bands of the same colour at the margins. This variety is by no means common.

γ. (Fig. 2 *a*.) Form resembling old adults, but sometimes more attenuated behind. Colour rich dark crimson with numerous transparent spots or freckles; dorsal area fuscous or ochreous, gradually merging into the crimson. A form freely met with.

δ. Central area entirely pale dusky yellow to fuscous, margins reddish or dull crimson-red, or entirely fuscous. This form is common, and the pale colour is undoubtedly due to the attacks of internal parasites.

Adult female during the final stage of parturition (fig. 1) of a uniform dark dull crimson, or reddish-

crimson, which after death changes to chestnut-brown, as already described.

Second-stage female (fig. 8) short ovate, fuscous, with transverse black bands more or less distinct, according to age. Examples may frequently be found bearing patches of the semi-transparent skin of the previous moult.

Male (fig. 10) pale crimson, with the head, thoracic bands, and apodema crimson-black; abdomen, legs, and antennæ paler and dusky. Eyes and ocelli black, shining; of the latter there are four dorsal and six ventral. Caudal filaments comparatively short. Halteres pale red, turned back over the thorax when the insect is at rest. Wings rather short, and suddenly widened at base. Stylus nearly as long as the abdomen.

Puparium of male (fig. 11) normal.

Long, 2·50 mm.

Male, second stage. Elongate, with the extremities equally rounded. Colour as in the young female, but the bands are generally less defined.

Ova pale yellowish-white.

Larva pinkish at first, but after fixing themselves they change to dull orange-yellow, with faint crimson shadings over the thoracic and cephalic areas; or dusky greenish, with the crimson more obscure; or uniformly reddish-brown (fig. 9).

*Habits.*—The larvæ hatch during the latter part of the summer, the first moult taking place before winter. Numbers disport themselves over the leaves of the food-plant (hawthorn), but descend to the branches on which they permanently fix themselves before winter. In winter they are very small, measuring 1·25–2 mm. long, and of a dull brownish colour. In spring they develop the transverse bands (fig. 8), and the sexes may then be separated, the males being much more elongate than the females. After the latter have attained their full size the puparium is formed, when pupation takes place, the males appearing during the last week in April and the first and second week in

May. At this period the females (figs. 2–2 *b*) have attained almost their maximum size, and the strongly contrasting colours render them very conspicuous. Egg-laying takes place at the end of May and early in June, and the number laid by a healthy female averages about 2000. In all the colonies I have seen there is a preponderance of females, but the male puparia may be found in considerable numbers in *large* colonies.

These insects are much subject to the attacks of a small hymenopterous parasite (*Blastothrix sericea*, Dal.), which is its chief enemy. The remarkable effect which these parasites produce on the external form of the insect has already been described. Professor Cockerell has noticed very similar malformations to those of var. *α* in a North American species of *Lecanium*, and I have received specimens from Austria very similar to the var. *β*. Not only is there an alteration of form caused by the parasites, but the colour is also changed—generally to a more or less uniform fuscous or yellowish colour.

In sheltered hedges of hawthorn this species is sometimes extremely abundant, so much so that I have known it to kill large patches of a hawthorn hedge skirting the borders of this city (Chester). Their ravages were particularly noticeable in the year 1890, when they certainly attained their maximum in numbers. Since that time they have gradually decreased through the attacks of natural enemies—both of birds and insects, more especially the latter. On large isolated trees they generally occur singly upon the terminal branches, and the sexes are often widely separated; in such cases it is highly probable that the females are rarely fertilised.

In describing this species I have confined myself entirely to a single colony of insects on hawthorn (*Cratægus oxyacantha*), in order to show that this species possesses all the varied characters set forth by former students of the group, which, I think, thoroughly

guarantees the synonyms set forth. In the majority of instances the earlier writers have formed their diagnoses from much too limited a series, often from a single specimen, which has led to endless confusion.

I do not propose here to enter into the details of the synonymy; much of this has already been set forth by Mr. Douglas (l. c.), and I have little doubt, had that author had the opportunity of examining and studying the materials personally, he would have arrived at a similar, if not identical, conclusion as myself.

*Habitat.*—On [1]hawthorn (*Cratægus oxyacantha*), [2]apple (*Pyrus malus*), [3]*Cotoneaster* spp., [4]elm (*Ulmus campestris*), [5]sycamore (*Acer pseudo-platanus*), [6]oak (*Quercus robur*), [7]alder (*Alnus glutinosa*), [8]willow (*Salix* spp.), [9]rose, cultivated and wild (*Rosa* spp.), [10]hazel (*Corylus avellana*), [11]lime (*Tilia* spp.), [12]horse-chestnut (*Æsculus* spp.), [13]laurel (*Prunus lauro-cerasus*), [14]cherry, [15]plum, [16]wild sloe (*Prunus* spp.), and [17]*Euonymus* sp. It occurs freely on Nos. 1, 2, 4, 5, 6, 7, 11, 12, and 13; but has been found less freely on 3, 8, 9, 10, 14, 15, 16, and 17.

It is abundant and generally distributed in suitable localities throughout England, but is apparently very local in Scotland and Wales. I have no Irish records.

*Distribution.*—Apparently very common in Europe. Dr. Reh* gives as food-plants Nos. 1, 2, 7, 12, and 15 of my list, and also† *Pyrus communis* and *Prunus armeniaca*. It is also recorded from North America (King), where it has probably been introduced.

## Explanation of the Plate.

Pl. LIV, fig. 1.—Adult females at period of parturition, natural size *in situ* on branch of hawthorn (from life).

* 'Jahrbuch der Hamb. Wissench. Anstalten,' xviii, p. 228 (1900).

† I have found quite recently a pear tree in the neighbourhood of Chester badly infested with this coccid.

Fig. 2.—Adult female at period of fecundation. × 6.
Fig. 2 *a*.—Another variety of the same. × 6.
Fig. 2 *b*.—Another variety of the same. × 6.
Figs. 3, 3 *a*.—Old adult females after death, natural size (posterior view).
Fig. 3 *b*.—Old adult female after death attached to base of spine (ventral view), natural size.
Fig. 3 *c*.—Old adult female after death, natural size (semi-profile view).
Fig. 4.—Parasitised form with double mammiform swellings (posterior view), very slightly enlarged.
Fig. 4 *a*.—Another parasitised form with the mammiform swellings much more elevated and placed closely together (profile), very slightly enlarged.
Figs. 4 *b*, 4 *c*.—Two parasitised forms without mammiform swellings, showing perforations through which the parasites have escaped. Natural size.
Figs. 5, 5 *a*, and 5 *b*.—Antennæ of the adult female. × 140.
Fig. 6.—Leg of the adult female. × 140.
Fig. 7.—Marginal spines of the adult female. × 140.
Fig. 8.—Second-stage female with part of previous moult attached to its back. × 10.
Fig. 9.—Larvæ (full-fed) prior to first moult. × 15.
Fig. 10.—Male. × 25.
Fig. 11.—Puparium of male. × 10.

## LECANIUM HEMISPHÆRICUM (Targioni-Tozzetti).

(Pl. LVI, figs. 1–12.)

*Lecanium hemisphæricum*, Targioni-Tozzetti; Stud. sul Coccin., 27 (1867); Catal., 38, 17 (1868).
*Chermes filicum*, Boisduval; Essai sur l'Ent. Horticole, p. 335 (1867).

*Lecanium coffeæ*,* Walker; List of Homoptera, p. 1079 (1852).

*Chermes hibernaculorum*, Boisduval; Essai sur l'Ent. Horticole, p. 337 (1867).

*Lecanium hibernaculorum* (Boisduval), Signoret; Essai, p. 266. Douglas; Ent. Mo. Mag., vol. xxiii, p. 78 (1886).

*Lecanium beaumontiæ*, Douglas; Ent. Mo. Mag., vol. xxiv, p. 95 (1887).

*Lecanium clypeatum*, Douglas; Ent. Mo. Mag., vol. xxv, p. 58 (1888).

*Saissetia*† *hemisphærica*, Cockerell; The Ent. Student, vol. ii, p. 32 (1901).

Old adult female after parturition (figs. 1, 1 *a*–1 *d*) varying from light brown or reddish-brown to dark brown or dark castaneous, frequently shaded with darker brown or black, the position and intensity of the latter being inconstant. Form more or less hemispherical, obovate or ovate, or slightly elongate, and highly convex; surface smooth and shining to the naked eye, but, under the microscope, the dermis is seen to be thickly studded with minute yellowish dots or points, indicating the position of the derm-cells; sides usually with irregular raised carinæ (fig. 1), the two strongest, which sometimes extend towards the subdorsal area, being the remnants of the strong lateral carinæ characteristic of the younger insect; these carinæ are usually much less distinct in the hemispheric forms, but very few examples occur without some trace of them; margins more or less narrowly flattened; body immediately above with a distinct, narrow, and well-defined constriction; dorsum frequently with a series of whitish secretionary projections forming a median line (fig. 1), and beneath the body is a rather thick secretion of white wax which generally projects beyond its margins. Antennæ

* Although bearing an earlier date than *L. hemisphæricum*, the latter is always given priority.

† Déplanches, Fauvel, 'Bull. Soc. Linn. Norm.,' ix, p. 127 (1865).

(fig. 2) of eight joints, of which the second, third, fourth, fifth, and eighth are longest, and the sixth and seventh shortest and of equal length; formula 3 (2, 4), 8 (1, 5) (6, 7). Legs (fig. 3) much longer than the antennæ, stout; there is a single longish hair on the coxa, a very long one on the trochanter, there are four on the tibia, of which that nearest the tibio-tarsal articulation is the longest, and at least two minute ones on the tarsus; digitules to claw so much dilated at base and apex as to almost obscure the claw, those of the tarsus comparatively short and simple. Anal ring of (?) six hairs. Dermis above (fig. 5 *b*) with numerous short ovate, clear derm-cells; ventral dermis thickly set with tubular spinnerets (figs. 5, 5 *a*), which are more numerous towards the margins; and there are four long hairs equidistantly placed around the anal lobes, and several others, of varying lengths, in two groups between the insertion of the antennæ. Marginal hairs (fig. 4) usually flattened at the extremity and variously serrated, but some are simple and slightly curved; in the majority of specimens they get broken off, either by removal from the food-plant or during preparation for the microscope. Stigmatic spines three in number, all of which are strong and blunt, and the central one is longest, but these, like the marginal spines, are also frequently broken off.

Hemispherical forms, 2–2·50 mm.

More or less ovate forms: high, 1·50–2 mm.; wide, 1·50–2·75 mm.; long, 2·25–4·25 mm.

Clypeate forms: high, 1–1·75 mm.; long, 1·25–3·25 mm.

Immature female (fig. 9) usually pale yellow, but sometimes opaque white, with a strongly defined central and two lateral carinæ, forming roughly the letter H.

Female at period of gestation (fig. 6) retaining the characteristic H-shaped carinæ of the younger insect. Colour rich, dark chocolate-brown, or plum colour, with the margins and carinæ paler; and the whole of

the dermis is thickly set with minute yellow specks or dots. Form short ovate or subcircular, slightly narrowed in front, and comparatively flat. During the period of parturition the H-shaped carinæ almost entirely disappear, only a very slight trace of the lateral ones being visible in the old adults, as previously described.

So far only typical forms of the old adult female have been described, being those which are found upon the flat surface of a leaf or a comparatively large branch of the food-plant. When, as is often the case, the female takes up a position on a slender stem, such as the hair-like stalk of the *Adiantum*, or other limited areas such as a midrib of a leaf, the form becomes much changed (figs. 1 *c*, 1 *d*), and frequently much dwarfed. This adaptation of form to environment no doubt misled the earlier writers, and induced them to create several species which, at most, can only rank as phytophagous varieties, the anatomical details being the same as in the typical *L. hemisphæricum*. The most marked varieties are given under the following heads.

*α*. Form slightly elongate-ovate and highly convex, with the H-shaped carinæ of the young female sometimes faintly traceable, more especially so at the sides. Usually smaller than the type. This is the *Lecanium filicum* of Boisduval, Signoret, and Douglas.

*β*. Form obtuse, oval, and highly convex. Colour usually dark chocolate-brown, paler on the dorsum, and suffused with blackish-brown at sides. This answers in some respects to *Lecanium hibernaculorum*, and is undoubtedly the form assigned to this variety by Mr. Douglas,* and confirmed by Signoret. This appears to be a well-nourished form; I have found it in this country on vigorous plants of *Pteris* sp. (fig. 1 *b*) and *Stephanotis*.

*γ*. Form resembling *L. filicum* in retaining the

* I have examined examples of Mr. Douglas's co-types described in 'Ent. Mo. Mag.,' vol. xxiii, p. 78 (1886).

dorsal carinæ, but smaller. The "whitish dots" mentioned by Douglas (l.c.) in his diagnosis of *L. beaumontiæ* are secretionary, and are characteristic of the species, but are rarely retained in old adults. Types of this form, kindly given to me by Mr. Douglas, are small and stunted, looking as if the food-supply had been in some way suddenly checked, and hence the retention of the strong "transverse ridges;" or the examples may have been young adults.

♂. Form "broad-oval, very convex, . . . sides more or less straight, margin not extended and flattened, except anteriorly as far back as the region of the primary lateral ridges, where it is greatly produced, clypeiform, in some examples to an obtuse point, mostly slightly recurved at the edge, and rough with strong punctures; sometimes also with a rough longitudinal carina. Viewed from the side, the scale, in the region of the previous dorsal carina, is more or less level, but it then curves somewhat suddenly both to the front and back." This is the description given by Douglas (l.c.) of his *L. clypeatum* (figs. 1 *c*, 1 *d*). An examination of the author's types shows no deviation in the structural details from typical *L. hemisphæricum*.

*Parasitised examples* (figs. 7, 8).—In these the form of the female is not appreciably changed, but the colour is more or less black, especially on the dorsum and towards the margins, while the immature examples are often of a beautiful pale mauve (fig. 8).

Puparium of male (fig. 10) very elongate, narrow, with the extremities equally rounded; dorsal carinæ forming the coronet narrowly separated, the enclosed space with a central series of angular projections; lateral carinæ in three pairs, anterior pair slightly curved outwards, with the ends almost reaching the anterior margin; second pair slightly anterior to the centre; posterior pair about midway between the latter and the anal margin.

Long, 1·25 mm.

Male light orange-red or coral-red, with darker

blotches on the collar; antennæ and legs paler; wings iridescent; eyes and ocelli pitchy black. Head, viewed in profile, pyriform, widest in front. Eyes conspicuous; ocelli four in number, very large, dorsal pair placed immediately behind the antennæ, ventral pair placed very low down. Antennæ of ten joints, very hairy; ninth joint with one or two additional long hairs, and the apical joint with, usually, four, of which the central pair are very faintly clubbed (fig. 12). Legs ordinary. Terminal segment of abdomen (fig. 11) with two pairs of tubercles; the lowest pair, being enormously developed, are thickly set with long hairs and articulated to a large chitinised joint or process, which is attached to the lateral sides of the base of the genitalia. Anal filaments ordinary, their place of attachment to the body bearing a few spinnerets and several hairs of varying length. Genital sheath or stylus with unusually long marginal hairs.

*Habitat* (under glass).—On various plants, and one of the commonest of our greenhouse coccids. It was first recorded as British by Mr. Douglas* from specimens obtained at Canterbury by Mr. G. S. Saunders. But long prior to this the insect must have been recognised as a pest by horticulturists. Douglas also records it from Sale, Cheshire (Cameron), in which county I find it abundant in many places; also in the London district; Deptford (W. Morris); and Armagh (Rev. W. F. Johnson). It is abundant at the Royal Gardens, Kew (Nicholson and Green), where I also have found it on various plants. Dr. D. Sharp has sent it from Cambridge, and it is common in the same county at Upwell and surrounding district. In Norfolk it is common in many places, and it was at Ingoldisthorpe, near King's Lynn, that I obtained males in a cool conservatory; these, so far, being the only examples known to have occurred in the British Isles. It is common also in many parts of Denbighshire, Flintshire, and Carnarvonshire.

* 'Ent. Mo. Mag.,' vol. xxiii, p. 78 (1886).

The food-plants are ferns of various species:—*Adiantum* spp.; *Pteris* spp.; *Asplenium* spp. It also occurs on various species of palms, on crotons, *Stephanotis*, *Beaumontia grandiflora*, *Bryophyllum calycrinum*, *Asparagus plumosus*, *Begonia* spp., *Coffea liberica* and *arabica*, *Stangeria schizodon*, *Eranthemum cinnibarinum*, *Clerodendron speciosum*, *Bowenia spectabilis*, *Casimeroa edulis*, *Eugenia malaccensis*, *Leucadendron argenteum*, *Schinus* sp., *Ardisia* sp., *Clavija* sp., *Aspidium* sp., *Rondeletia* sp., *Sarcocephalus* sp., *Muhlenbergia* sp.

*Habits.*—A very prolific species, but it never gains headway on well-kept plants, its large size rendering it a very conspicuous insect, and the horticulturist generally managing to keep it in check by removing it with his fingers. Eggs and larvæ are produced throughout the year, even in cool houses and cottages, there being no regular succession of broods. The females are universally parthenogenetic; the males, being extremely rare, have only twice been met with during the last thirty-five years. About the year 1867 Boisduval (l. c.) briefly described the colour of the male for the first time, and my own examples, obtained in Norfolk, are, I believe, the only other instances of its occurrence. Boisduval does not give the name of the plant from which he obtained the males; but mine were taken from ferns (*Pteris* spp.) in August, 1891. Occasionally one finds the female attacked in this country by chalcidid parasites, but it is generally free from such enemies; it is, however, much more subject to the attacks of a fungus to which it readily succumbs. Mr. Cockerell* has also observed a similar, if not identical fungoid disease in Jamaica, and suggests that it is "probably a state of some cordyceps."

*Distribution.*—Europe (Signoret); Channel Islands (Luff); Ceylon (Green); Japan (Kuwana); Cape Colony, South Africa (Lounsbury); United States of America, West Indies (Cockerell and Maxwell-Lefroy);

* 'Bull. Botan. Dept., Jamaica,' n. s., vol. i, p. 71.

Brazil (Hempel); and Australia (Maskell). It is recorded as a common species, and frequently injurious to plants of various kinds. It lives out of doors in the warmer parts of the world; but, in other latitudes, it is found only under glass.

## Explanation of the Plate.

Pl. LVI, fig. 1.—Adult female after parturition. × 15.
Figs. 1 *a*, 1 *b*.—Normal forms of adult female natural size *in situ* on *Adiantum* and *Pteris*.
Figs. 1 *c*, 1 *d*.—Clypeate forms of adult female natural size *in situ* on stems of *Adiantum*.
Fig. 2.—Antenna of the adult female. × 140.
Fig. 3.—Leg of the adult female. × 140.
Fig. 4.—Marginal spines of the adult female. × 600.
Fig. 5.—Portion of ventral dermis of the adult female, with tubular spinnerets.
Fig. 5 *a*.—Tubular spinnerets from ventral dermis. × 600.
Fig. 5 *b*.—Portion of dorsal dermis with derm-cells. × 300.
Fig. 6.—Female at period of gestation showing H-shaped carinæ. × 15.
Fig. 7.—Parasitised female. × 15.
Fig. 8.—Early stage of same. × 20.
Fig. 9.—Female, first stage. × 20.
Fig. 10.—Puparium of male. × 15.
Fig. 11.—Terminal segment of the male (slightly restored), with central portion of the genital sheath or stylus omitted. × 140.
Fig. 12.—Terminal joints of male antennæ. × 300.

## Lecanium perforatum (Newstead).

(Pl. LV, figs. 1–11.)

*Lecanium perforatum*, Newstead; Ent. Mo. Mag., s.s., vol. v, p. 233, figs. 1–3 (1894).

Adult female (figs. 1, 2, 3) viviparous; dark piceous, with a more or less obscure blotch of blackish-crimson above the anal cleft; extremely flat, short ovate, and narrowed in front, or broadly pyriform; surface shining, more especially so over the respiratory channels; tesselation of dermis faintly indicated on the dorsum by very faint carinæ, which are much interrupted and disconnected. By transmitted light the dermis (above) appears as shown in fig. 3, and is composed of a number of large, irregular, angular, and deeply-divided plates, forming a remarkable polygonal tesselation; the two dorsal series are large, and are divided by a clearly-defined straight line, extending from the anal lobes to the centre of the cephalic area, which is there connected with the central pair of anterior marginal plates; subdorsal series irregular, somewhat interrupted; submarginal series similar, but more interrupted; four or five of the series on the abdominal segments have large, clear spaces, resembling perforations, with jagged edges (fig. 5); marginal series very long, tapering inwards, bearing numerous clear spaces or gland-like pits (fig. 4); all the plates bear a few minute, clear, circular perforations, placed at irregular intervals close to the margin; and many of those on the dorsum also bear curious ornamentations resembling dendritic markings found in certain geological deposits. Antennæ (figs. 6, 6 *a*, 7) slender, of eight joints, of which the second, third, fourth, and eighth are much the longest, the three terminal joints being finely ringed or crenulated: all the hairs are extremely slender; the last joint (fig. 7) bears one at the apex and five at the margins;

formula (3, 8), (2, 4), 1 (5, 6, 7). Legs (fig. 7) well developed, but rather slender; there is a single long hair at the end of the tibia, on the underside, and a similar one on the coxa; digitules to tarsi ordinary; those of the claw very long, dilated, and truncate at the extremity. Eyes (fig. 4 *a*) *retained after treatment with potash*, in the form of a minute truncated cone, situate in a clear fusiform space between the marginal plates. Stigmatic spines (fig. 12) from three to five in number, the central one being much the longest, and curved. Marginal spines (fig. 12 *a*) minute, chiefly simple, but a few are divided at the tips (fig. 12 *b*). Anal lobes (figs. 9, 11) very thin, flat, and angular; apex with three or four minute hairs. On the ventral surface is a strong, inwardly projecting, and highly chitinised lever-like organ (figs. 10 *b* and 11 *b*), which has a broadly-dilated base attached to the outer portion of the retractile tube which envelops the hairs of the anal ring; the latter is furnished with six long hairs (figs. 10 *a* and 11 *a*), and just below the fold of the retractile tube are two pairs of long tubercles, each bearing a single long hair (fig. 10 *c*); and there is a group of minute spinnerets just within the anal cleft (fig. 10 *f*). On either side of the anal ring above are two very long hairs and several minute ones.

Long, 3·50–4 mm.; wide, 2·50–3 mm.

Young adult female dull reddish-brown or bright chestnut-brown, frequently with a trace of dull crimson. Younger forms (fig. 2) dusky orange-yellow; eyes black, shining.

Larva dull reddish; antennæ of six joints, of which the third and sixth are longest; fourth and fifth equal, about the same length as first and second. Rostral filaments unexpanded, extending beyond tibiæ of posterior legs, the latter rather short; digitules to tarsi ordinary. Anal setæ rather shorter than is usual in the genus. Margins with a few stout hairs. A single blunt spine occurs at the margin of each of the spiracular openings.

*Habitat* (under glass).—On *Caryota Cumingii*, *Wallichia densiflora*, and other palms in the Royal Botanic Gardens, Kew, where it was first discovered by Dr. D. Morris. When searching for coccids at Kew in 1898, I found this remarkable species the most abundant member of the genus; and when fixed to the greyish undersides of the leaves of the *Wallichia* palms it was very conspicuous (*see* fig. 1). While palms are undoubtedly its favourite food-plants, I have also taken it freely at Kew on *Eugenia malaccensis*, *Diospyros* sp., and *Coccoloba* sp.; and I have received it from near Edinburgh, on *Anthurium* sp.; and from the Botanic Gardens, Liverpool, on an unnamed plant.

*Distribution.*—Recorded from several localities, under glass, in the United States of America.

All the authorities who have dealt with this species, since its discovery in August, 1894, have treated it as a variety of *L. tessellatum*, Signoret. In describing the species (l. c.) I pointed out its relationship to the latter, but claimed as the clearly distinctive characters the eight-jointed antennæ and the very marked *central division* of the dermal tesselation. While I am quite willing to admit that Signoret may easily have made a mistake as to the number of joints in the antennæ, I cannot conceive how he could possibly have overlooked the very distinct central division in the dermal tesselation, a character sufficient in itself to guarantee the erection of the species.

## Description of the Plate.

Pl. LV, fig. 1.—Insects natural size *in situ* on underside of leaf of *Wallichia densiflora*.

Fig. 2.—Young adult female. × 10.

Fig. 3.—Adult female showing tesselation as seen by transmitted light. × 10.

Fig. 4.—Marginal plates with eye in clear fusiform space at *a*. × 40.

Fig. 5.—One of the posterior submarginal plates

with large subcentral gland-like perforation, and smaller perforations at margins. × 40.

Figs. 6, 6 *a*.—Antennæ of adult female. × 140.

Fig. 7.—Terminal joints of same. × 300.

Fig. 8.—Leg of the adult female. × 140.

Fig. 9.—Anal lobes (closed). × 40.

Fig. 10.—Anal ring and surrounding organs (ventral): *a*, base of anal ring; *b*, chitinised lever, probably used for opening and closing anal lobes; *c*, spine bearing tubercles; *d*, upper portion of anal cleft; *e*, dotted line indicating the position of the anal lobes; *f*, ventral spinnerets. × 140.

Fig. 11.—Anal ring and surrounding organs (dorsal) with the anal lobes and ring thrown backwards and upwards by pressure of the covering glass. The letters *a–e* apply to the same parts as those in fig. 10. × 140.

## Lecanium nigrum (Nietner).

(Figs. 5 *a–e* in text.)

*Lecanium nigrum*, Nietner; Enemies of the Coffee Tree, p. 9 (1861).

*Lecanium depressum*, Targioni-Tozzetti; Stud. sul Coccin., 29 (1867); Catal., 37, 38 (1868).

*Lecanium begoniæ*, Douglas; Ent. Mo. Mag., s.s., vol. iii, p. 209, figs. 4, 4 *a* (1892).

Adult female long-oval or broad-ovate, slightly narrowed and produced in front, one side often more curved than the other; low convex, and sometimes faintly carinated in front, with the margins flat, somewhat produced, and sometimes faintly wrinkled. Anal lobes often porrected in the dead specimens. Colour shining dark chestnut-brown, brown-black, or piceous. Young examples are brown. Under the microscope the surface is seen to be covered with clear brownish-

yellow, polygonal derm-cells, but the angles are so rounded that they appear more or less ovate; the space between the cells very dark brown or black, forming a distinct reticulation; when viewed by transmitted light the derm-cells (Fig. 5, *a*) are seen to have a central, clear pore or nucleus, and the angles of the cells appear less rounded than when seen from above. Dermis at the margins without derm-cells or reticulations. Marginal hairs (Fig. 5, *b*) small, simple; and

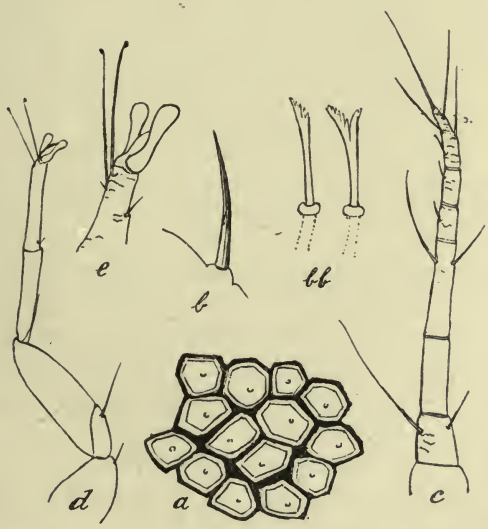



FIG. 5.—*Lecanium nigrum*, Nietn., ♀: *a*, polygonal derm-cells, × 140; *b*, marginal spine, × 600; *bb*, inner marginal spines, × 600; *c*, antenna, × 140; *d*, leg, × 140; *e*, claw with digitules, × 300.

just within the margins are a few more or less divided hairs (Fig. 5, *bb*) connected with tubular spinnerets. Antennæ (Fig. 5, *c*) normally of seven joints, of which the fourth is the longest and constricted towards the apex, from which arises two long hairs; there is also a stiff, spine-like hair on the fifth and sixth joints; formula 4, 3, 7, 2, 1 (5, 6). Exotic examples have sometimes eight-jointed antennæ, when the formula is 3, 8 (1, 2, 4, 5), (6, 7). Legs (Fig. 5, *d*) slender; digi-

tules to claw (Fig. 5, *c*) long, and much dilated at base and apex.

Long, 3–4 mm.

*Habitat.*—On *Heliconia metallica* * at the Royal Botanic Gardens, Kew, which is the only record of the occurrence of the species in this country.

*Distribution.*—In Europe at Paris, and Florence, Italy; India and Ceylon, Australia, New Zealand, Sandwich Islands, Demerara, and Brazil.

## Lecanium oleæ (Bernard).

(Pl. LVII, figs. 1–13.)

*Chermes oleæ*, Bernard; Mém. d'Hist. Nat. Acad., 108, pl. ii, fig. 25 (1782).
*Lecanium palmæ* (Haw., 1812), Cockerell and Parrott; The Industrialist, 1899, p. 163.
*Coccus testudo* (Curtis), "Ruricola;" Gard. Chron., iii, 443, with fig. (1843).
*Chermes cycadis*, Boisduval; Essai sur l'Ent. Horticole, p. 323 (1867).
*Lecanium oleæ* (Bernard), Signoret; Essai, p. 270.
*Bernardia oleæ* (Ashmead), Cockerell; Trans. Am. Ent. Soc., xx, 54 (1893).
*Neobernardia oleæ*, Cockerell; Trans. Am. Ent. Soc., xx, 54 (1893).
*Saissetia oleæ* (Bernard), Cockerell; Ent. Student, vol. ii, p. 31.

Old adult female (figs. 1, 2) brownish-black, rarely quite black, short ovate, being usually a little longer than broad, high convex, with a very strongly-pronounced dorsal, and two lateral carinæ forming the letter **H**; surface more or less shiny, irregularly and coarsely rugose, the rugosities in many parts forming

* Green, 'Ent. Mo. Mag.,' s.s., vol. viii, p. 71 (1897).

small indefinite tubercles, surmounted by a white, flake-like secretion, which is very pronounced in the young adults; derm-cells indicated on the exterior by minute yellow specks or points placed close together over the whole area. Antennæ (fig. 4) of eight joints, of which the third is longest, and the sixth and seventh are shortest; formula 3 (2, 4), 5, 8, 1 (6, 7). Legs (fig. 5) a very little longer than the antennæ; digitules (fig. 5 *a*) to claw very long and stout, with the extremities moderately dilated. Derm-cells (figs. 7, 7 *a*) elongate, each one enclosed within an irregular but strongly defined polygonal tesselation. Ventral dermis (fig. 8) with numerous small, tubular spinnerets, and a few scattered, short, stout spines (fig. 9). Stigmatic spines (fig. 10) three in number, of which the centre one is much the longest. Marginal spines or hairs (fig. 6) simple or flattened at their apex, and variously serrated.

Long, 2·50–4 mm.; wide, 1·50–3 mm.; high, 1·50–2·50 mm.

Female at period of gestation (fig. 11) comparatively flat; dingy mauve in the centre, shaded to dusky yellow at the sides; H-shaped carinæ strongly indicated and paler in colour than the rest of the body; eyes black. As the insect matures it changes to a dark brown colour, which is not infrequently maintained in the old adults. "Flake-like secretion" as in the old adults, but a little more pronounced. Female, first stage (fig. 12), elongate-ovate, with H-shaped carinæ strongly indicated; central area mauve or orange-mauve, shading to yellow at the sides.

Puparium of the male (fig. 13) very elongate. Mr. Green* says it is "studded with irregular waxy plates, as in the female, those on the median line being most defined and very prominent."

Pupa "pale greenish with a dark brown, median, longitudinal line" (Green, l. c.)

The male was described, for the first time, by Dr.

* 'Ent. Mo. Mag.,' s.s., vol. viii, p. 72, fig. 2.

B. W. Griffith, California, in the 'Los Angeles Times' of 2nd July, 1893, and subsequently by Mr. Alexander Craw in a 'Bulletin of the Californian State Board of Agriculture.' I have only seen Mr. C. L. Marlatt's account of the male in his valuable work on 'The Scale Insect and Mite Enemies of Citrus Trees,' in which the author gives an excellent figure of the male and the pupa. I am indebted to him for the above information.

Ova yellowish.

Larva reddish-pink.

*Habitat* (under glass).—First recorded by Curtis in 1843 on *Brexia spinosa*, a native of Madagascar. In 1887 Douglas recorded it on *Brexia madagascariensis* and *Cratægus gynandra*, from the Royal Botanic Gardens, Kew, where it still exists, and affects the following plants:—*Aralia elegantissima*, **Croton eluteria*, **Avicenia nitida*, **Elæodendron orientale*, **Carissa spinarum*, **Catesbæa spinosa*, *Spathelia simplex*, *Thyrsacanthus rutilans*, *Miconia magnifica*, *Leucadendron argenteum*, *Clavija minor*, and *Encephalartos* spp. Mr. Green records it from Yalding, Kent; and Dr. D. Sharp has sent it to me from Cambridge. But it does not appear to be widely or generally distributed as a greenhouse pest in this country.

*Habits.*—The females are almost universally parthenogenetic. Dr. B. W. Griffith, California, was the first to discover the male of this species; he found the puparia on oleander, orange, lemon, pepper, and ivy leaves, between the months of November and April, in the Los Angeles country; but I believe the male has not been found in the perfect stage in any other part of the world. Mr. E. E. Green (l. c.) was the first to discover the male puparia, containing pupæ, in this country, and I have received from Mr. Nicholson a damaged specimen on a leaf of *Spathelia simplex* which he obtained for me at Kew. In this country the species appears to be quite immune from the attacks of parasites, but in other countries it has

* Green, 'Ent. Mo. Mag.,' s.s., vol. viii, p. 72 (1897).

several enemies. Mr. Cockerell * says: "It is known to be attacked by a fungus in Australia; in California a species of *Capnodium* . . . . was found on dead scales, and it was surmised that it might attack living ones.

"The larva of a moth, *Erastria scitula*, Rambur, preys on it in Europe; while in Australia it is similarly attacked by the larva of *Thalpochares coccophaga*, Meyrick.

"A beetle, *Rhizobius ventralis*, Er., was found useful as an enemy of the black scale in California; this beetle is a native of Australia, whence it had been introduced to feed on scale-insects.

"A chalcidid parasite, *Tomocera californica*, Howard, destroys it in California; . . . . in 1889 it was observed that 80 per cent. of the scales were destroyed by this parasite."

It is a very general feeder, and almost universally destructive.

*Distribution.*—Common in Southern Europe; a pest in the United States of America; abundant in the West Indies, Ceylon, New Zealand, Australia, and Hawaii. It appears also to occur throughout Europe on cultivated plants, presumably under glass.

## Explanation of the Plate.

Pl. LVII, fig. 1.—Insects natural size *in situ* on branch of *Spathelia simplex*.

Fig. 2.—Old adult female, typical form. × 10.

Fig. 3.—Adult female (comparatively flat, brown form). × 10.

Fig. 4.—Antennæ of the adult female. × 140.

Fig. 5.—Leg of the adult female. × 140.

Fig. 5 *a*.—Claw with digitules of same. × 300.

Fig. 6.—Marginal spines of the adult female. × 600.

Figs. 7, 7 *a*.—Polygonal derm-cells. × 300.

* 'Bull. Bot. Dept. Jamaica,' n. s., vol. i, p. 72 (1894).

Fig. 8.—Portion of ventral dermis with spinnerets. × 600.
Fig. 9.—The same with large spine. × 600.
Fig. 10.—Stigmatic spines of the adult female. × 300.
Fig. 11.—Female at period of gestation. × 10.
Fig. 12.—Female, first stage. × 20.
Fig. 13.—Puparium of male (after Green). × *circa* 25.

## Genus Physokermes (Targioni-Tozzetti).

(Pl. LVIII, figs. 1–11; Pl. LIX, figs. 1–5, 5 *b*.)

In both the larval and second stages of the female this genus is inseparable from *Lecanium*. But the adult female is both destitute of legs and antennæ, and at the period of parturition the body is divided by a central septum or body-wall into two internal cavities or pouches for the reception of the ova. In order to understand the complex structure of the internal parts of this remarkable insect a careful study of the figures on Pl. LVIII should be made.

On removing an adult female from the branch of its food-plant, in its external characters it is seen to somewhat resemble a species of *Kermes;* more especially do the forms which fix themselves in the bifurcations of the branches; but the cephalic extremity is always more or less attenuated. There is always a deep ventral slit present, and the posterior extremity is furnished with two blunt cornicles. By partly embedding the insect on its side in wax and cutting off a portion of the exposed lateral half of the body, the structure of the interior may be made out (Pl. LVIII, fig. 3). The abdomen (*b*) varies in thickness according to the age of the insect: at the commencement of parturition it is very thick, and nearly fills the whole of the pouch or cavity (*c*); but in the penultimate stage, which is that shown in fig. 3, the body is thin,

and after parturition forms a mere shell, each pouch or cavity (*e*, in both figs. 3 and 3 *a*) occupying one half of the whole interior; the cavities are separated by a central wall (*c*, *d*, in figs. 3 and 3 *a*) having a long transverse slit (*f*, in figs. 3 and 3 *a*), at the dorsal extremity of which is situate the genital orifice (*g*). It would seem, therefore, that as the ova are passed out of this orifice they fall on either side of the partition-wall, and are received into the pouches, the latter becoming larger and larger as the process proceeds, until the pouches finally occupy the whole of the interior and are filled with eggs. Owing to the folding inwards of the dermis along the ventral slit, it is impossible to trace out the true position of the rostrum and the surrounding parts in the living insect, but by boiling it in caustic potash the parts swell out. The rostrum (figs. 4 *b* and 5 *b*) is then seen to be placed towards the centre between the cornicles (*c c*) and the cephalic extremity (*d d*); immediately below the rostrum are four comparatively large attenuated processes, converging towards and almost enclosing the rostral filaments; and between the posterior pair, towards their bases, is an opening leading to the internal pouches for the escape of the larvæ.

So far as known this genus is monotypic, and I believe it is the only member of the Lecaniinæ which possesses internal marsupia or pouches. Mr. Claude Fuller * has described a species of *Callipappus*, belonging to the sub-family Monophlebidæ, which has also an internal marsupium, formed by the "complete intussusception of several of the abdominal segments of the mature females, . . . . in which the eggs are laid and incubated." I have also found indications of a similar internal marsupium in the monotypic genus *Aspidoproctus*,† but owing to the limited material at my disposal I was not able to trace out its true character.

* Fuller, 'Trans. Ent. Soc. Lond.,' 1899, pt. iv, p. 436.

† Newstead, "On a New Scale-insect from Zomba, B.C.A.," 'Proc. Zool. Soc.,' Dec., 1900, pp. 947, 948, pl. lix, figs. 1-9.

## Physokermes abietis (Geoffroy).

(Pl. LVIII, figs. 1–11; Pl. LIX, figs. 1–5, 5 *a*, 5 *b*.)

*Chermes abietis rotundus*, Geoffroy; Hist. abrég. Ins., ii, 507, 7 (1764).

*Coccus abietis*, Modeer; Götheb. Vetens. Handl., i, 27, 20 (1778). Gmelin; Syst. Nat., i, 2221, 32 (1791).

*Lecanium abietis*, Signoret; Essai, p. 273, 50.

*Coccus piceæ*, Schrank; Fauna Boica, 146, 1271 (1801). Boisduval; Entom. Hort., 320 (1867).

*Coccus hemicryphus*, Dalman; K. Vet. Acad. Handl., 1825, p. 369, 6, tab. iv, figs. 18–27.

*Physokermes hemicryphus*, Sign.; Essai, p. 280, pl. xiii, figs. 1–1 *c*.

*Coccus* (*Lecanium*) *racemosus*, Ratzeburg; Stett. Ent. Zeit., iv, 204; Forstins., iii, 191, 1.

*Lecanium racemosum*, Goureau; Ins. nuis., 159. Signoret; Essai, 275, 52, pl. xii, fig. 16.

*Physokermes abietis* (Geoff.), Newstead; Ent. Mo. Mag., s.s., vol. iv, p. 207, figs. 1–4 (1893); Coccidæ Brit. Isles, vol. i (Ray Soc.), pp. 1, 5, 6, 28, 50 (1901).

Adult female at period of parturition (Pl. LVIII, fig. 1; Pl. LIX, figs. 1–4) bright chestnut-brown, frequently with dull crimson blotches or shadings, and sometimes also with black suffused markings, especially at the posterior extremity; after death all trace of crimson disappears, and the insect changes to a uniform dusky brown, yellowish-brown, or fuscous; these colours being retained in cabinet specimens. The external form of the female varies considerably, according to its position on the branch of the food-plant, but all the forms may be classed under two heads: those fixed between the bud-scales and the branch (Pl. LVIII, fig. 1; Pl. LIX, figs. 1–4), and those occupying less confined positions, such as the

bifurcations of the branches or similar situations. These forms are described below under *α* and *β* respectively.

*α*. Form more or less wedge-shaped, with the exposed posterior portion broadly rounded outwards from the comparatively flat ventral surface (Pl. LIX, figs. 2, 3); anterior portion completely hidden between the bud-scale and the branch, suddenly attenuated anteriorly, and exactly fitting the inequalities of its resting-place.

*β*. Form more or less spheroid, with the ventral surface slightly flattened and the cephalic extremity suddenly attenuated. This form is comparatively rare in this country.

There are many forms intermediate between *α* and *β*. In some instances the cephalic extremity is suddenly truncate or emarginate (Pl. LIX, fig. 4), but it is usually much attenuated. On macerating the insects in caustic potash, and observing them without pressure (Pl. LVIII, figs. 4, 5), the cephalic extremity appears more pointed than in the living insect, due, undoubtedly, to the swelling out of the irregularities of the dermis, which in life bears the impressions of the food-plant. Cornicles (Pl. LIX, figs. 5–5 *b*) at posterior extremity shining black, hemispheric or elongate, and sometimes double (fig. 5 *b*); there is a deep ventral slit extending from the cornicles towards the cephalic extremity, and on the dorsal surface are usually three radiating grooves or depressions, the central or dorsal groove being deepest, the outermost pair less pronounced. Dorsal dermis (Pl. LVIII, fig. 6 *a*) with a distinct pentagonal tesselation, and large derm-cells, which are more numerous towards the posterior extremity, more particularly in the region of the cornicles (fig. 6), where they are also much smaller and appear to have long connecting tubes. Mentum (Pl. LVIII, fig. 7) short, with several fine hairs at the apex; filaments, when expanded, rather long. Spiracles (Pl. LVIII, fig. 9) somewhat trumpet-shaped, with a long stem and a broadly dilated and circular flange. Anal ring (Pl. LVIII, fig. 8) very small, and probably

circular; but the only example traceable appears transversely ovate and without hairs.

Long, 2·50–4·50 mm.

Second-stage female elongate-ovate, flat, with the margins slightly constricted at the spiracles. Antennæ (Pl. LVIII, fig. 11) of six joints, the third being equal in length to the fourth, fifth, and sixth; formula 3, 6 (1, 2), 4, 5. Legs resembling those of *Lecanium*. Ventral dermis (Pl. LVIII, fig. 10) with wavy, confluent lines of a bead-like structure, and short, isolated, spiny hairs. Anal ring hairy, but the number of hairs is doubtful. Colour pale reddish-brown, or pink, exactly corresponding with that of the bark of the spruce.

Male.—Unknown in any stage in this country; but Ratzeburg * gives a full description of it, accompanied by excellent figures of the insect in various stages. He describes it as yellow-brown, with the shield of the thorax (? apodema) somewhat darker; antennæ pale rosy red; legs brownish-yellow; eyes and ocelli black; wings with the simple nervures red. The antennæ are described as having nine joints, but this is probably an error of observation, the normal number in the Lecaniinæ being ten. His figure shows that the insect is remarkably like the male of *Lecanium capreæ* (Pl. LIV, fig. 10).

Puparium of the male.—I gather from Ratzeburg's description and figures that this also resembles the puparium of *L. capreæ*.

Ova at first pale crimson, but changing to dull mauve, and distinctly farinose.

*Habitat.*—Exclusively confined to the spruce fir (*Abies excelsa*). Very abundant in Delamere Forest, Cheshire, and more sparingly in other parts of the county. I have found it also in the north-east district of Leeds; at St. Albans, Tring, and King's Langley, in Herts; Cheltenham, Witcombe district, and Painswick, in Gloucestershire; and in Flintshire, North Wales. Mr. T. R. Hodges found it sparingly at Stratford-on-Avon;

* 'Forstinsecten,' vol. iii, p. 296, pl. xi, figs. 8, 8 E, F.

Mr. Nicholson has sent it to me from the Royal Gardens, Kew; and Mr. Thomas Shepheard has collected it in the Bournemouth district.

*Distribution.*—Apparently common in many parts of Europe, but to the best of my knowledge it has not been met with in any other part of the world.

In Bohemia, Dr. Karel Šulc has discovered quite a giant form of this interesting species (Pl. LVIII, fig. 2, after Šulc), which is much inflated and resembles a large *Kermes*. I suggested that the examples sent to me were parasitised, but Dr. Šulc assures me that they are not so. Nothing approaching this giant form has yet occurred in this country, but seeing the great interest attached to its discovery, I have ventured to have Dr. Šulc's beautiful drawing reproduced on the plate, in the hope that it may induce others to search for it here.

*Habits.*—The internal marsupia or pouches of the female may be found filled with eggs at the beginning of June. The larvæ hatch towards the end of July, and invariably fix themselves head downwards, generally beneath the bud-scales at the base of the young growth (Pl. LVIII, fig. 1 *a*), and often so arrange themselves that they quite surround the branch (Pl. LVIII, fig. 1), where they remain for the rest of their lives, without apparently changing their quarters. They hibernate without making any material change, and in spring effect a moult and secrete a small quantity of white flocculent matter. As the female advances to maturity, the abdominal extremity of the body gradually appears above the bud-scales, and when it has fully matured the body protrudes beyond the bud-scales about two thirds of its entire length (Pl. LVIII, fig. 1); and whether there is one, or a series of females as shown in the illustration, the resemblance to an unopened bud, or buds, of the spruce is very remarkable.

I have not found this species attacked by birds, which is not to be wondered at seeing that the young are protected during the winter months beneath the bud-

scales. But it is much subject to the attacks of the small chalcidid parasite, *Encyrtus scaurus*, Walk., which destroys quite 50 per cent. of these insects. During the month of August, 1891, I also succeeded in rearing from this coccid several examples of a small beetle (*Brachytarsus varius*); and in July of the same year, a beautiful little dipteron with golden wings, which the late Dr. Meade identified as *Diplosis latibulorum*, Winnz. It is highly probable, however, that the larva or pupa of the latter insect was in some way attached to the small portions of the spruce fir to which the coccids were fixed, and cannot, without further evidence, be considered a parasite. I record the fact in order that it may not be lost sight of.

## Explanation of the Plates.

Pl. LVIII, fig. 1.—Female insects natural size *in situ* on branch of spruce fir.

Fig. 1 *a*.—Terminal bud-scales under which the larvæ locate themselves.

Fig. 2.—Remarkable variety of the female, natural size, discovered in Bohemia by Dr. Karel Šulc (after Šulc).

Fig. 3.—Adult female with left-hand portion of body cut away, revealing the left-hand internal cavity or pouch with the ova. *a a*, line of section shown at fig. 3 *a*; *b*, abdomen with a few remaining ova ready for extrusion; *c*, central body-wall or septum; *d*, posterior portion of same; *e*, cavity or pouch containing extruded ova; *f*, slit in central wall or septum; *g*, approximate position of genital orifice. × 20.

Fig. 3 *a*.—Transverse section of adult female at *a a* in fig. 3. *b*, abdomen with few remaining ova ready for extrusion; *c*, central body-wall or septum (dorsal portion); *d*, ventral portion of same; *e*, cavity or pouch for the reception of the ova; *f*, slit in central wall or septum.

Fig. 4.—Adult female after maceration in potash. *b*, rostrum; *c*, cornicles; *d*, cephalic extremity (profile). × 20.

Fig. 5.—Ventral view of adult female after maceration in potash. *a*, opening at ventral extremity of partition wall or septum; *b*, rostrum; *c*, cornicles at posterior extremity; *d*, cephalic extremity. × 20.

Fig. 6.—Dorsal derm-cells of adult female, near cornicles. × 140.

Fig. 6 *a*.—Derm-cells of adult female, with reticulation. × 140.

Fig. 7.—Rostrum of adult female, with filaments. × 140.

Fig. 8.—Anal ring of adult female. × 300.

Fig. 9.—Spiracle of adult female. × 600.

Fig. 10.—Ventral dermis of second-stage female. × 600.

Fig. 11.—Antennæ of second-stage female. × 140.

Pl. LIX, fig. 1.—Adult females *in situ* surrounding branch (posterior view). × 6.

Fig. 2.—Adult female *in situ* (semi-dorsal view). × 20.

Fig. 3.—Adult female *in situ* (dorsal view). × 20.

Fig. 4.—Adult female removed from branch, with the cephalic extremity exposed (ventral). × 20.

Figs. 5, 5 *a*, 5 *b*.—Cornicles of adult female.

## Hemicoccinæ.

In preparing the synopsis of the sub-families of the Coccidæ given in vol. i, p. 67, of this work, I adopted Mr. Green's brief diagnosis of the sub-family Hemicoccinæ. I did so chiefly because I had not, at that time, sufficient material for fully studying the genus *Kermes*. Having now obtained fresh material, I find that the typical females of this genus have *not* "*cleft extremity and anal plates as in Lecanium.*" The anal orifice, which is non-setiferous, is placed well within the

ventral surface of the abdominal area, and there is no trace of anal lobes. As an amended diagnosis I therefore propose the following:

Adult females *without* cleft extremity or anal lobes; anal orifice non-setiferous. Larva *with* anal lobes and setiferous anal orifice as in the Dactylopiinæ. Includes the genus *Kermes* only.

## Genus Kermes (Boitard).

Many of the females in this remarkable genus resemble berries or galls, and one or more species are used in the production of a valuable dye.

In a popular sense the name *Kermes* has been used from very early times, but Mr. Cockerell * says that Boitard was the first author who employed the name in scientific nomenclature. The latter includes in his genus *Kermes variegatus*, Gmelin, *K. ilicis*, Linn., and *K. reniformis*, Sign. ( = *K. quercûs*, Linn.), besides species of *Lecanium*, etc. In *K. variegatus*, *K. ilicis*, *K. galliformis*, Riley, and many others, the form of the female is globular, with a very slight incision for insertion on the branch or stem of the food-plant. *K. quercûs* is usually reniform in shape, but it often bears a striking resemblance to a small grain of maize, both of the rounded and flat varieties. *K. gibbosus*, Sign., shows a remarkable deviation from the above in having the body formed of several gibbose segments, divided along the back by a deep suture; while *K. nivalis*, King and Cockerell, resembles a *Lecanium*, and, like the members of that genus, has a broad base of attachment. Europe and North America are richest in the number of species; there being about eight species recorded from the former continent, and fifteen from the latter.

Many of the adult females retain their legs and antennæ; in *K. variegatus* they are well developed,

* 'Proc. Acad. Nat. Sciences of Philadelphia,' 1899, p. 269.

but in such species as *K. quercûs* and *K. nivalis* these organs are either atrophied or rudimentary. The anal orifice is hairless, and there is an entire absence of caudal tubercles, or they are barely indicated, as in *K. Kingii*, Cockerell,* by "brown, chitinous, bristly patches."

The male undergoes its final transformations in a felted sac or puparium somewhat like that of the members of the genus *Dactylopius*. According to Signoret † the males resemble those of the Coccinæ (here Dactylopiinæ). In *K. bauhinii* (the only species observed by Signoret) the head is globular, with four eyes and six ocelli. Antennæ of ten joints, with several knobbed hairs on the terminal joint. Wings long. Abdomen long, with a short genital armature and two long caudal filaments.

With regard to the eyes, there can of course be but one pair; correctly, therefore, there must be four pairs of ocelli, and all these latter are shown in Signoret's figure to be on the *upper* surface of the head.

The distinctive features of the larva (Pl. LX, fig. 8) are its well-developed anal lobes, which stand out quite clear of the margin; they are *not* recessed or placed *within* a cleft, as in the Lecaniinæ.

Briefly the characters of the genus may be set forth as follows:

Adult female usually globular in form; naked, or partly or wholly covered by secretion. Antennæ and legs either well developed, atrophied, or rudimentary, the antennæ consisting of not more than six joints. Male puparium felted. Larva with prominent anal lobes, and six hairs to the anal orifice.

### Synopsis of Species.

**A.** Adult female globular, antennæ and legs well developed.

(i) . . . VARIEGATUS.

* 'Ann. Nat. Hist.,' ser. 7, vol. ii, p. 330.

† Signoret, 'Essai,' p. 304.

**B.** Adult female more or less reniform, antennæ and legs atrophied.
(ii) . . . . QUERCÛS.

### KERMES VARIEGATUS (Gmelin).

(Pl. LX, figs. 1–11.)

*Coccus variegatus*, Gmelin; Syst. Nat., 1, 4, 2216, 5 (1788).
*Kermes variegatus* (Gmelin), Signoret; Essai, p. 308, pl. xiv, fig. 4.

Adult female (figs. 1–3) usually globular, but slightly longer than broad, and sometimes slightly produced in front (fig. 3); smooth and somewhat shining, and under a lens faintly punctate. Colour bright ochreous yellow, or pale brownish-yellow, usually with four irregular, transverse, dark chestnut-brown or blackish bands on the thoracic area, which are broadly interrupted on the dorsum; there is also a short irregular band between the first and second and the second and third thoracic bands; the succeeding bands are much less conspicuous, and gradually diminish in length and breadth as they approach the anal orifice; cephalic area (fig. 3) with a double series of spots, which sometimes coalesce and form indistinct bands or blotches; midway between the latter and the first thoracic band is a pair of much larger spots, and there is a similar pair of spots between the first and second and the second and third thoracic bands. In a small specimen before me the bands and spots are less distinct and have coalesced in places. Ventral surface attached to branch (fig. 1 *a*) very small, more or less circular, and completely covered with a rather thick layer of tough, white secretion. Anal orifice (figs. 1 *a*, 7) linear and constricted towards the centre. Antennæ (fig. 4) of six joints, of which the third is

much the longest; the second and three terminal joints are of equal length and very short; formula 3, 1 (2, 4, 5, 6).* Legs (fig. 5) rather short and stout, but much longer than the antennæ; coxæ unusually large; tibiæ a little shorter than the tarsi; digitules present, and apparently simple. Dermis above with numerous simple derm-cells; ventral dermis (figs. 6, 6 *a*) with a few isolated spines and numerous large tubular spinnerets (fig. 6 *b*), which are grouped together in places (fig. 6 *a*).

The colours are retained, indefinitely, after death.

Diameter, 5–8 mm.

*Habitat.*—On the terminal branches of the oak (*Quercus robur*) in part of the Blean Woods, Herne, Kent. Mr. Charles O. Waterhouse discovered this remarkable species in September, 1897. He says, "I only found five examples on rather thick stems close to a bud or knot in each case. They were on oak shrubs in a wood, which I believe is part of the Blean Woods." I have no other British record of this remarkable species.

*Distribution.*—Signoret records it from Hyères and other parts of Southern France. It has also been found in Italy (Berlese) and at Podbaba, Bohemia (Šulc). So far as I have been able to ascertain, the species is local and rare. Examples kindly sent to me from Italy by Professor Berlese are much more brightly coloured than those obtained in this country by Mr. Waterhouse.

## Explanation of the Plate.

Pl. LX, fig. 1.—Female insect natural size *in situ* on branch (profile).

Fig. 1 *a*.—The same removed from branch (ventral).

Fig. 2.—Old adult female after parturition (profile). × 4.

* I have been able only to dissect out one antenna, and cannot, therefore, say if there be any variation in the antennal formula.

Fig. 3.—The same (anterior view). × 4.
Fig. 4.—Antenna of adult female. × 140.
Fig. 5.—Leg of the adult female. × 140.
Figs. 6, 6 *a*.—Portions of ventral dermis of the adult female. × 600.
Fig. 6 *b*.—Tabular spinnerets of the adult female. × 600. (On the plate the figure 6 is reversed.)
Fig. 7.—Anal orifice of the adult female. Enlarged.
Fig. 8.—Larva (ventral). × 100.
Fig. 9.—Antenna of the larva. × 300.
Fig. 10.—Leg of the larva. × 300.
Fig. 11.—Anal extremity of the larva. × 300.

## KERMES QUERCÛS (Linnæus).

(Pl. F, figs. 1, 1 *a*, 1 *b*, 2.)

*Coccus quercûs*, Linnæus; Syst. Nat., Ed. x, 1758, p. 455.
Gallinsecte en forme de rein, Réaumur; Mém. Hist. Ins., t. iv, tab. 6, figs. 1–4 (1738).
*Chermes quercûs reniformis*, Geoffroy; Hist. Abr. Ins., vol. i, p. 508, No. 13 (1762).
*Kermes reniformis* (Réaumur), Signoret; Essai, p. 307.
*Kermes quercûs* (Linn.), Cockerell; Proc. Acad. Nat. Sciences of Philadelphia, p. 207 (1899). King; Psyche, 1901, pp. 258, 259. King and Reh; Sond. a. d. allgemeinen Forst- und Jagd-Zeitung, 1901, pp. 1–3. Newstead, Ent. Mo. Mag., s.s., xiv, p. 57 (1903).

Adult female (figs. 1–1 *b*) more or less reniform, or rarely subglobular; posterior extremity generally depressed or emarginate; anterior extremity suddenly and very narrowly attenuated, the attenuation usually short and pedunculate. Old examples are either naked and shining, or farinose, with a lateral shield-shaped patch of secretion on either side of the dorsum

at the posterior extremity. Colour varying from yellowish-brown to dark reddish-brown or crimson-brown, with several more or less interrupted transverse black bands, which are less distinct, narrowed, and much more arched at the posterior extremity. Antennæ atrophied, articulations indistinct. Legs atrophied, articulations indistinct. Dermis above with numerous clear, gland-like spaces; in the centre of each is a highly chitinised, circular spinneret, with a large inner connecting tube. Ventral dermis with many long, tubular spinnerets, and short, stiff hairs. Anal orifice linear, placed about midway between the anal and posterior extremities. Rostrum *directed forwards* and placed near the end of the slender, attenuated anterior extremity of the insect; mentum biarticulate, rather long, and a little wider at the base than at the centre. Spiracles large; parastigmatic glands numerous.

Long, 3–5 mm.; wide, 2·50–4 mm.

Mr. Geo. B. King (l. c.) describes the salient characters of the young female larvæ as follows:—"Caudal tubercles small, each with one long bristle 180 $\mu$ long, one spine-like hair 40 $\mu$ long, one short spine 16 $\mu$ long, and one glandiform spine. A little distance above the anal orifice are two ordinary spines 16 $\mu$ long. Antennæ six-jointed; formula 6 (1, 2, 3, 5), 4, or 6, 1 (2, 3), 5, 4. All the joints have short, thin hairs. Middle legs short, stout."

Larva (extracted from the body of the parent, and therefore probably immature) short ovate. Antennæ of six joints; the first joint is much the widest; the second, third, fourth, and fifth are the shortest; each joint is furnished with a few fine slender hairs and a pair of minute, laterally placed spines; apical joint much the longest, bearing several long hairs and two or three shorter curved ones; formula 6 (1, 2, 3, 4, 5). Legs much longer than the antennæ, and very broad at the tibio-tarsal joint; claw very long; digitules simple. Anal lobes minute, each with a single

obtusely-pointed spine, and a long, spine-like hair. Character of anal orifice doubtful, but there are traces of (? 6) spines on the posterior portion of the orifice, and there are two slender spines a little anterior to the latter. Mentum biarticulate; filaments extremely long.

Male puparium (fig. 2) a white, felted, elongated sac, 1·50 mm. long.

*Habitat.*—In the crevices of the bark of the oak (*Quercus robur*). This most interesting addition to our fauna was discovered by Mr. Harold J. Burkill, at the foot of the S.-W. slope of Wimbledon Common, near the Beverley Brook. The first batch of specimens reached me through my friend Mr. George Nicholson, to whom, I believe, they were sent as vegetable galls. On hearing of the importance of his discovery Mr. Burkill made several expeditions to the locality, obtaining a further supply of specimens, and also some important information with regard to the local distribution of the species. In his first communication, dated 22nd May, 1902, he says that the scale-insect "was on the trunks of three trees, all near together, but not on some of the trees in between these, and seemed to extend from about three to eight feet from the ground. The trees were on the small side in development, the trunks being about ten inches or slightly less in diameter, and the insects were to be found all round the trunk and not restricted to one special aspect. I should estimate the number at about 100 to 120 on the three trees. My second visit, when I got the specimens sent to you, was a very hurried one in a bad light, so there may be other trees attacked that I was near, but did not notice." In the second letter, dated 18th June, Mr. Burkill adds: "I have been to the locality the last three Sundays. . . There are a good number of trees infested—I should think I have seen the old skins of the insect on forty or more,—but many likely-looking trees in the same area seem to be free, and where the trees are more exposed the

insects seem to prefer the south-east side, though a few specimens are on the opposite side.

"I have only been able to find one male, and that disappeared on the way home."

The material sent to me consisted for the most part of old, dead females, containing the effete skins of the ova; but a careful examination of the crevices of the bark revealed three immature females enveloped in wax and woolly filaments; and there were also two empty male puparia attached to a small fragment of bark (fig. 2), from one of which the male referred to by Mr. Burkill probably emerged, and subsequently escaped from his collecting box. On 15th July, in the same year, Mr. Brockton Tomlin found the species in great numbers at Sherwood Forest, and from a freshly fallen tree obtained a fine series of females *in situ* (fig. 1). These examples contained living larvæ, which continued to hatch for a week or more after they came into my possession. Wishing to establish the species in my garden, I fastened a piece of the bark, tenanted by about a dozen females, to a young oak; on visiting the tree four days later I found that every example had been taken, and not a fragment of the old skins had been left. To the best of my knowledge there were no titmice (*Paridæ*) about my garden at the time, and I can only surmise that the coccids were either eaten or destroyed by sparrows.

*Habits.*—From the somewhat scanty material supplied to me it is impossible to trace out the complete life-history of this interesting species, but I gather that the larvæ hatch about the middle of June, when they fix themselves in the deep crevices of the bark of the oak; one moult evidently takes place before winter, but the females hibernate in a very young stage. The males appear in June while the females are still very small, and a month later the females produce larvæ. Thus the period between fecundation and parturition appears to be abnormally short, and further investigation will therefore be necessary to verify this statement.

The length of the pedunculated, or attenuated, anterior extremity of the adult female is evidently determined by the depth of the crevice in the bark in which the larva first fixes itself; should the crevice be shallow and narrow the peduncle is correspondingly short and slender; in instances where the crevice is comparatively broad and deep the body is more gradually attenuated, and the shape not unlike that of a miniature grain of maize; on comparatively smooth bark the peduncle is extremely short, and the body almost spherical.

*Distribution.*—Outside the British Isles it has been found only on the continent of Europe. It had, apparently, been lost sight of for nearly a century, when it was re-discovered by Dr. K. Šulc at Jřeboň, Bohemia, in July, 1897. Shortly afterwards it was taken by Karl L. Kafka, I believe near Vienna; and in September, 1899, Dr. L. Reh found examples at Borstel, near Hamburg. I am much indebted to all three collectors for a series of specimens, which are specifically identical with those found in this country.

### Explanation of the Plate.

Pl. F, figs. 1, 1 *a*, 1 *b*.—*Very slightly* enlarged photograph of old adult females *in situ* on oak bark. The females opposite figs. 1, 1 *a* are quite naked; those opposite fig. 1 *b*, and five others in the central crevice, are partly or wholly covered in cereous matter.

Fig. 2.—Two male puparia; the lower one shows the exit hole of a chalcidid parasite.

### Dactylopiinæ.

Adult females active or stationary, naked or covered with mealy, cottony, waxy, horny, or glassy secretion.

Antennæ and legs either well developed, rudimen-

tary, or entirely absent; when present the last joint of the antennæ is usually much longer than the penultimate. Anal lobes generally small or rudimentary, but well developed in *Eriococcus*. Anal orifice setiferous.*

Larvæ exhibiting anal lobes and setiferous anal orifice similar to those of the adult females.

### Female.

The females of this division are distinguished chiefly by the character of the anal lobes, which, although varying in degrees of development, are always present. In the typical genus *Dactylopius* (Pl. LXIV, figs. 3, 15) the lobes, with few exceptions, are very small or rudimentary—characters which also apply to the genera *Asterolecanium* (Pl. LXII, figs. 2, 7, 8) and *Ripersia* (Pl. LXVII, fig. 4; Pl. LXVIII, figs. 5, 12). All the members of the genus *Eriococcus* (Pl. LXXI, figs. 5, 12) have large anal lobes, and for this reason the genus has been placed by some authors in a separate division of the Coccidæ. The usual number of hairs to the anal orifice is six or eight, but *Cryptococcus* (Pl. LXX, fig. 4) has only four, while the exotic genus *Kermicus* † has seventeen.

### Female Ovisac.

In *Dactylopius* the ovisacs are usually formed of loose, white, flocculent secretion, often quite devoid of form, and aggregated in masses on the food-plant (Pl. LXV, fig. 10). Some members of the genus *Ripersia* provide similar ovisacs, while others are formed of brittle, pulverulent, white secretion, or a thick and rather closely felted secretion as in *Ripersia tomlinii* (Pl. LXVIII, fig. 1). In *Cryptococcus* (Pl. LXX, figs. 6, 6 *a*) the ovisacs are also felted, and often

* Cockerell ('Canad. Ent.,' vol. xxxi, p. 277) includes species having a non-setiferous anal orifice. I consider such species inadmissible to the group.

† Newstead, 'Ent. Mo. Mag.,' s.s., vol. viii, p. 170, figs. 1–5 (1897).

so thickly packed together as to completely cover the bark of the tree. *Eriococcus* (Pl. LXXI, figs. 1, 1 *a*) makes a neat and very closely felted sac provided with a small orifice at the anal extremity for the exit of the larvæ. The members of the genus *Asterolecanium* (Pl. LXI) are easily distinguished by the hard, semi-transparent, and fringed ovisac, which, like that of *Eriococcus*, is also provided with an opening at the anal extremity for the escape of the larvæ.

### Male.

The chief characteristic of the males of the British genera is the comparatively short and somewhat complex structure of the genital armature. Whether we take the closely allied genera *Dactylopius* (Pl. LXIV, fig. 8) and *Pseudococcus* (Pl. LXIII, figs. 8, 8 *a*), or the extremely aberrant genus *Apterococcus*, we find the general character of the genitalia much the same in all three. In the comparatively few descriptions of the exotic species which I have seen the same characters seem to prevail. But in the incomplete state of our knowledge of these organs little importance can at present be attached to them in the classification of the Coccidæ. Both winged and apterous species occur in this division, but the former are much more frequent than the latter.

### Male Puparium.

The puparia are usually felted (Pl. LXVII, figs. 11, 12), but in *Asterolecanium* they are semi-transparent, and, although much smaller, they closely resemble the ovisacs of the adult females.

### Larva.

Typical larvæ (Pl. LXVI, fig. 1; Pl. LXVIII, fig. 8) possess six-jointed antennæ, the anal lobes and anal

orifice resembling those in the adult insect. In the aberrant genus *Cryptococcus* (Pl. LXX, fig. 7) there are only five joints to the antennæ, and four spiny hairs to the anal orifice; while the larva of *Apterococcus* (Pl. LXXII, fig. 10) is distinguished by the rows of truncate spines on the dorsum.

### Synopsis of Genera.

**A.** Adult females stationary, enclosed in a glassy or horny, fringed ovisac (test).
(I) . . Asterolecanium (1).

**B.** Adult females active, covered with mealy secretion, not enclosed in ovisac.
*a.* Female antennæ of eight joints.
(II) . . . Dactylopius (2).

**BB.** Adult females enclosed within ovisac at gestation.
*a.* Female antennæ of nine joints.
(III) . . . Pseudococcus (3).
*b.* Female antennæ of six, rarely of five or seven joints.
(IV) . . . Ripersia (4).

**C.** Adult females stationary, living from the earliest stage within the ovisac; antennæ and legs rudimentary or absent.
*a.* Anal orifice of adult female with four spiny hairs.
(V) . . . Cryptococcus (9).
*b.* Anal orifice of adult female with six long hairs.
(VI) . . . Antonina (7).

**CC.** Antennæ and legs present; anal orifice with six flattened hairs.
(VII) . . . Apterococcus (8).

**D.** Anal lobes of adult female very large; body with long marginal or dorsal spines.
(VIII) . . . Eriococcus (5).

**E.** Body of adult female with numerous short conical spines.
(IX) . . . Gymnococcus (6).

## Genus Asterolecanium (Targioni-Tozzetti).

In 1893, and again in 1894, the late Mr. Maskell expressed an opinion that all the then known species of this division of the Coccidæ should be placed under the genus *Planchonia*, but as this name was preoccupied it has been abandoned, and priority given to *Asterolecanium*. I quite agree with that author, however, in placing all the known members of the division under one genus. In treating of *Asterolecanium variolosum*, Ratz., in Vol. I of this work, I unfortunately adopted the name *Asterodiaspis quercicola*, given to it by Signoret in 1876. My reason for doing so was that I could not then find any trace of the characteristic hairs on the anal orifice, but as I now find that there are two minute ones, I have replaced the species under *Asterolecanium*.

The females of this genus are completely enclosed in a sac of opaque or semi-transparent waxy, horny, or glass-like secretion, the margins of which are usually furnished with a fringe of glass-like rods or waxen plates, and there is a small opening at the anal extremity for the exit of the larvæ (see Pl. LXI, figs. 1–15).

The ovisac is usually designated the "test," but as the secretion is not attached to the body of the insect, the term should, in my opinion, be abandoned.

The adult females are apodous, and the antennæ are either absent or rudimentary. The anal lobes are also more or less rudimentary, or comparatively small; and the margins of the integument are furnished with a single or double row of fringe-secreting glands shaped like the figure 8 (Pl. LXII, figs. 3, 8, 18).

### Synopsis of Species.

**A.** Ovisac of female with a dorsal series of filaments or tufts.

(1) . . . . . THESII (2).

**B.** Ovisac without dorsal filaments.

*a*. Ovisac elongate.

(II) . . . . BAMBUSÆ (1).

*b*. Ovisac approximately circular or short ovate.

(III). . . . VARIOLOSUM (3).

### ASTEROLECANIUM BAMBUSÆ (Boisduval).

(Pl. LXI, figs. 1–5; Pl. LXII, figs. 6–15.)

*Asterolecanium bambusæ* (Boisduval; Insectologie agricole, 1870), Signoret; Essai, p. 168, pl. vii, fig. 3.

*Planchonia fimbriata*, var. *bambusæ* (Boisd.), Maskell; Trans. N.Z. Inst., 1894, p. 62.

*Planchonia* (*Asterolecanium*) *bambusæ* (Boisd.), Maskell; Ann. and Mag. Nat. Hist., ser. 6, vol. xvi, p. 135 (1895).

*Planchonia bambusæ* (Boisd.), Green; Indian Museum Notes, vol. iv, No. 1, p. 4 (1896).

*Bambusaspis bambusæ* (Boisd.), Cockerell; The Entomologist, vol. xxxv, p. 114 (1902).

Ovisac of adult female (Pl. LXI, figs. 1–4) glassy and semi-transparent; elongate, highly convex, and slightly narrowed behind; transverse anal opening at the extreme margin; ventral surface normally more or less flat, but varying according to its position on the food-plant—sometimes it is quite convex, but when fixed to a slender branch (Pl. LXI, fig. 5) it is deeply concave. Colour varying according to the age of the imprisoned insect, or of its other contents. In young examples (Pl. LXI, fig. 5) it is of a uniform pale lemon-yellow; at the period of parturition (Pl. LXI, figs. 3, 3 *a*) the anterior half is usually of a more or less ochreous yellow, with dull crimson blotches, the posterior portion being paler; after the escape of the larvæ the anterior third is usually dark brown, with the remaining portion dusky ochreous (Pl. LXI, fig. 4).

The empty ovisac is of a pale straw-colour. The fringe of long, pink, glassy rods forms a single compact series all round the margin.

Long, 2–3·50 mm.; wide, 1–1·25 mm.

Adult female, after treatment with potash (Pl. LXII, fig. 6), elongate, narrowed posteriorly. Rudimentary antennæ (Pl. LXII, fig. 9) usually with one long and one short spiny hair. Rostrum (Pl. LXII, fig. 10) very large, more or less pyriform, and formed of unusually broad bands of chitin; mentum small and widely rounded at the apex; unexpanded filaments scarcely longer than the mentum. Spiracles rather large, bases broad. Anal extremity (Pl. LXII, fig. 7) faintly produced; anal lobes small but distinct, each furnished with a single long hair; the space between the lobes chitinised, margin with four slight indentations producing four minute tuberculate projections, each bearing a minute spine. Anal orifice with six long hairs, which pass under a slender chitinous band or loop. Marginal compound spinnerets (Pl. LXII, fig. 8), shaped like the figure 8, form a single series all round the margin, and within them on the dorsum is a single series of small simple spinnerets as in *A. variolosum*.

Male apparently unknown in any stage.

Larva (Pl. LXII, fig. 11) narrowly elongate. Antennæ (Pl. LXII, fig. 12) of six joints, of which the sixth is much the longest, and equals the third, fourth, and fifth together; formula 6, 1 (2, 3, 4, 5). Legs (Pl. LXII, fig. 13) rather long, with the tarsi broadening towards the claw; digitules simple, those of the tarsi very long. Anal lobes rudimentary. Anal orifice with six hairs. Marginal compound spinnerets resembling those of the adult female, but much more widely separated.

Second-stage larva with the tibiæ and tarsi (Pl. LXII, fig. 14) much broader than those of the embryo, and the antennæ (Pl. LXII, fig. 15) also shorter and stouter.

Ova (Pl. LXI, fig. 3) pale yellow.

*Habitat.*—On various species of bamboo (*Bambusa*) at the Royal Gardens, Kew, where I discovered it in July, 1896. It was most abundant on *Bambusa vulgaris*, many of the leaves and stems being almost covered with the insects. Their presence on the leaves is marked by yellow stains.

*Habits.*—During the early period of gestation the female fills the ovisac, but as parturition advances her body shortens, thus making space for the ova at the posterior extremity. After death the body of the female changes to a dark brown colour. A number of overlapping broods are produced in the summer months—eggs, larvæ, and both old and young adults occurring at the same time.

*Distribution.*—Found originally on cultivated bamboos in Algeria (Boisduval). It is common at Assouan, Upper Egypt; the West Indies (Cockerell, Maxwell-Lefroy); Brazil (Hempel); and Ceylon (Green). I can find no records of its occurrence in any part of Europe besides Britain; but I am under the impression that it has been met with in Italy.

## Explanation of the Plates.

Pl. LXI, fig. 1.—Insects natural size *in situ* on portion of a leaf of bamboo.

Fig. 2.—Ovisac of adult female with ventral portion removed, revealing the female at period of gestation. × 15.

Fig. 3.—Another example with a portion of the ventral part of the ovisac removed, revealing the female at period of parturition and the cavity behind her filled with the yellow ova. × 15.

Fig. 3*a*.—Ovisac of adult female with the crimson blotches of the sub-lying insect showing through. × 15.

Fig. 4.—Ovisac of old adult female after the death of the insect. × 15.

Fig. 5.—Ovisac of young adult on slender stem of bamboo. × 15.

Pl. LXII, fig. 6.—Adult female after treatment with potash (ventral). × 20.

Fig. 7.—Anal extremity of adult female with anal lobes and anal orifice. × 140.

Fig. 8.—Marginal spinnerets of adult female. × 600.

Fig. 9.—Rudimentary antenna of adult female. × 600.

Fig. 10.—Rostrum of adult female. × 140.

Fig. 11.—Larva after treatment with potash. × 100.

Fig. 12.—Antenna of the embryo larva. × 300.

Fig. 13.—Leg of the embryo larva. × 300.

Fig. 14.—Leg of the second-stage larva. × 300.

Fig. 15.—Antenna of the second-stage larva. × 300.

### Asterolecanium thesii (Douglas).

(Pl. LXI, figs. 6–8; Pl. LXII, figs. 16–18.)

*Pollinia thesii*, Douglas; Ent. Mo. Mag., s.s., vol. iv, p. 55, figs. 1–4 (1893).

Ovisac of the adult female (Pl. LXI, figs. 6, 7) "pale yellow or dingy brown, smooth, slightly shining, very hard and convex, subovate, broadest in front, posteriorly more or less produced, the prolongation flattened and narrowed to an obtuse or bifid end (this is more evident on the insect beneath); anal aperture situate at the margin, small, round, emitting a tuft of delicate glassy filaments; . . . dorsum with a median longitudinal, mane-like row of upright or curled, delicate, flossy, white filaments of unequal height, disposed in 5–6 adjacent tufts, and arising out of the integument; margin with a projecting fringe (Pl. LXI, fig. 8) of fine, distinct, glassy, hair-like filaments disposed in two series, those of the upper one not so close together as the lower. . . . The underside

of the scale is closed by a thin pellicle. The sides of the scale are approximated in order that they may grasp the thin stem of the food-plant, to which they closely adhere. The closure of the scale causes the insect to be quite enveloped; after death it becomes shrivelled. . . . There were no eggs or larvæ in the scales, but a brown one contained the larva of a parasite that quite filled the space" (Douglas, l. c.). After the death of the female the ovisac changes to pale ochreous.

Long, 2–2·25 mm.

Adult female (Pl. LXII, fig. 16) approximately circular, posterior extremity (Pl. LXII, fig. 17) suddenly produced. Rudimentary antennæ bearing one long hair and four or five short ones. Mentum doubtfully biarticulate, short; rostral filaments (loop) short. Marginal spinnerets (Pl. LXII, fig. 18) shaped like the figure 8, and disposed in two rows at the front and sides, but placed alternately as to the respective rows, posteriorly merging into one nearly straight row (fig. 18). Anal ring recessed within a larger one, bearing six hairs. Anal lobes rudimentary, each indicated by a single long hair, and between them near the anal orifice are two shorter hairs and several minute ones. Dorsum with numerous long tubular spinnerets, and a few scattered circular spinnerets.

*Habitat.*—On *Thesium humifusum*, Isle of Purbeck; discovered by Mr. Eustace R. Bankes, 12th July, 1892. With the insects, which were forwarded to Mr. J. W. Douglas, Mr. Bankes sent the following particulars:—"While spending the day yesterday in the Isle of Purbeck, in searching for pupæ of *Chauliodus insecurellus* on the scarce, local, and little-known plant, *Thesium humifusum* (a parasite on other plants), I found the scale-insects I now send. They were in every case attached to the underside of the twigs, sometimes in a little cluster, generally near the base of the plant, and not easily seen if the plant is examined from the underside" (Douglas, l. c.). I have seen but

two examples of this pretty little coccid; they were kindly given to me by my friend Mr. J. W. Douglas, and formed part of the series of his types from which he drew up his original diagnosis. The species has not been found elsewhere in the British Isles, or in any other part of the world.

### Explanation of the Plates.

Pl. LXI, fig. 6.—Insect (test) *in situ*, *slightly* enlarged.
Fig. 7.—Ovisac of the adult female (profile). × 12.
Fig. 8.—Fringe of the ovisac of the adult female. × 35.
Pl. LXII, fig. 16.—Adult female after treatment with potash (ventral). × 25.
Fig. 17.—Abdominal extremity of adult female. × 140.
Fig. 18.—Dorsal compound figure-of-8 spinnerets. × 600.

### Asterolecanium variolosum (Ratzeburg).

(Pl. D, Vol. I, fig. 2; Pl. LXI, figs. 9–15; Pl. LXII, figs. 1–5 *a*.)

*Asterolecanium quercicola*, Signoret *et Auctt.* (*nec Lecanium quercicola*, Bouché).*
*Coccus variolosus*, Ratzeburg; Tharander, Jahrbuch, xx, p. 187 (1870) (not seen; *fide* Judeich and Nitsche).*
*Lecanium quercûs*, "L" (*nec* Linné); Altum, Forstzoologie, iii, Insecten, p. 365 (1881).*
*Coccus variolosus*, "Ratzeburg MS.;" Hagen, Canad. Entom., 1887, p. 60 (no description).*
*Planchonia fimbriata* (Fonscolombe), Maskell; Extract, Trans. N.Z. Inst., 1894, p. 62.

* This part of the synonymy is from Cockerell, 'Proc. Acad. Nat. Sciences of Philadelphia,' 1899, p. 269.

*Coccus quercicola*, "Sign;" Judeich and Nitsche, Lehrbuch der Mitteleur.-Forstinsektenkunde, vol. ii, p. 1252 (1895).*

*Planchonia quercicola* (Bouché), Maskell; Trans. N.Z. Inst., vol. xxviii, p. 396 (1895).

*Asterodiaspis variolosus*, Boas; Dansk. Forstzoologie, 1896–98, p. 395.*

*Planchonia* (*Asterolecanium*) *quercicola* (Bouché), Froggatt; Dep. of Agr. Sydney, N.S.W., Miscel. Pub., No. 175, p. 6 (1897).

*Asterodiaspis quercicola* (Bouché), Newstead; Coccidæ of the Brit. Isles (Ray Soc.), vol. i, pp. 1, 14, 34, 35, 36, 39 (1900).

Ovisac of old adult female (Pl. LXI, figs. 10, 13) broadly ovate or subcircular, slightly attenuated behind; anal opening transverse, narrow, and partly filled with secretion; very convex above, shining, with the surface faintly rugose. Fringe opaque glassy-white, but usually matted together, irregular, and sometimes entirely wanting in very old examples. Ventral surface convex, but less so than the dorsal surface, and also much less transparent. Colour varying according to the age of the enclosed insect; in the summer, when the insect fills the test, it is of a uniform yellowish-green, or sap-green (Pl. LXI, fig. 11); in early spring the colour changes to yellowish-brown or dark brown; and later in the year the anterior portion covering the body of the dead female changes to madder-brown or brownish-black, with the posterior portion covering the eggs or their effete skins greenish-yellow (Pl. LXI, fig. 13), the line of demarcation between the two colours being often quite abrupt. The empty ovisac is more or less golden-yellow with a faint tinge of green.

Diameter, 1–2 mm.

Ovisac of the young adult (Pl. LXI, figs. 11, 12)

* This part of the synonymy is from Cockerell, 'Proc. Acad. Nat. Sciences of Philadelphia,' 1899, p. 269.

yellowish-green, darkening with age. On the dorsal surface are, usually, five longitudinal series of widely separated, thin, waxy plates, representing the early larval secretion which has become fissured and separated along the lines of growth by the accretion of fresh material. At this stage the marginal fringe is in its most perfect condition.

Adult female, after treatment with potash (Pl. LXII, fig. 1), approximately circular; anal extremity faintly produced. Rostral filaments about twice the length of the mentum, the latter short and broadly rounded. Spiracles rather large; parastigmatic glands extending in a narrow band to the margin. On the ventral surface of the last three or four abdominal segments (Pl. LXII, fig. 2) are a number of circular spinnerets and a few minute spines. Anal orifice (Pl. LXII, fig. 5) extremely minute, being scarcely larger than the figure-of-8 spinnerets at the margins, and bearing two minute spines. Dorsal tubular spinnerets (Pl. LXII, fig. 4) very long, numerous, and scattered over the whole of the dorsal area. Marginal spinnerets (Pl. LXII, figs. 3, 3 *a*) shaped like the figure 8, arranged in *a single series all round the body*. Rudimentary antennæ (Pl. LXII, fig. 5 *a*) usually with one long and one short spiny hair.

Long, 1–1·25 mm.

Secretionary covering of the second-stage female (Pl. LXI, fig. 14) elongate-ovate. Colour sap-green or yellowish-green, and so closely resembling the colour of the young branchlets of the oak that it is very difficult to detect the insect without the aid of a lens. Fringe (Pl. LXI, fig. 15) consisting of opaque, glassy-white rods arranged in pairs, with the ends curving outwards and inwards and thus forming two lateral loops, each loop reaching the succeeding loop on either side, so that the whole forms a complete series round the entire margin of the secretionary covering.

The gall-pits of the adult female are very deep, completely enclosing the highly convex *ventral* surface

of the test; there is also, very frequently, a central depression opposite the region of the rostrum. The external swelling is usually prominent, and either approximately circular or elongate.

Diameter of circular swelling, 1–2·50 mm.; length of elongated swellings, 1·50–5 mm.

The puparium of the male is described by Signoret as long oval, of a clear, brilliant yellow, with a weak median carina, having a marginal fringe similar to that of the female.

Long, 1 mm.

The male, also described by Signoret, is brownish-yellow upon the head and thorax, and of a clearer yellow upon the abdomen; eyes, antennæ, legs, and apodema black.

Long, 0·35 mm.

*Habitat.*—Confined exclusively to the oak (*Quercus robur*). It is abundant in many parts of Cheshire, and I have met with it sparingly in suitable localities in Flintshire and Denbighshire; at Ledbury, Herefordshire; in various parts of the Cotswolds, Gloucestershire;* St. Albans, King's Langley, and Tring, Herts; Briston, Barningham Parva, Blickling, Aylsham, and Tatterford, in Norfolk; Chislehurst, Orpington, Farnborough, and Bearsted (Green), in Kent. Mr. T. R. Hodges finds it common in the neighbourhood of Stratford-on-Avon.

*Habits.*—The eggs are laid in spring, and the secretionary covering of the second-stage female (Pl. LXI, fig. 14) is completed early in May. At this period the formation of the characteristic gall-pit with the accompanying swelling (Pl. D, Vol. I, fig. 2) is commenced, and it is completed towards the end of September. In cases where the larvæ fix themselves on the hard wood of the previous year they are unable to produce the characteristic gall-pits, or to cause the surrounding tissues to swell.

The fondness of birds (*Paridæ*) for this interesting

* Mr. C. J. Watkins informs me that it is common on stunted oaks at Stroud.

little coccid has already been dealt with, and as I have nothing further to add I must refer the reader to the chapter dealing with the natural enemies of the Coccidæ (Vol. I, pp. 34–39), under the name *Asterodiaspis quercicola*.

*Distribution.*—Probably indigenous to Europe. It was first observed by Signoret as an injurious species about the year 1836 near Paris, and he stated that certain oaks in the Bois de Boulogne were practically destroyed by it. It has since been recorded from other parts of the continent of Europe, but I believe more or less sparingly. Dr. Fletcher found it in considerable numbers at Ottawa, Canada, on oaks imported from Pennsylvania; and King records it from Niagara, Ontario. It has also been found on imported oaks at Washington, U.S.A. In 1895 Maskell (l. c.) received it from Nelson, New Zealand, and he says that the twigs of oak from that locality "were so thickly covered with the little greenish-yellow tests as to be in places invisible." Shortly afterwards the species was found to be equally abundant at Sydney, N.S.W. Dr. Froggatt (l. c.) says, "Last year the Director of the Botanic Gardens sent me a number of twigs from the oaks growing in the outer domain upon which the leaves were withered at the tips, and the shoots in a dying condition, from the immense number of scales covering them. Shortly afterwards I examined the oaks in the Botanic Gardens, and found that the tips of every twig were surmounted with four or five dead leaves, giving them a very curious appearance. The twigs just at the tips, and for a few inches down, were covered with the bright yellow scales, which, though scattered down the branchlets, did not appear to extend for several feet to the main branches." The occurrence of such abnormal numbers of this coccid was probably due to the absence of the European members of the Paridæ, which have been found to feed upon the insects so extensively in this country.

### Explanation of the Plates.

Pl. D, Vol. I, fig. 2.—Photograph of five oak branchlets with the insects *in situ*.

Pl. LXI, fig. 9.—Insects natural size *in situ* on oak branchlet.

Fig. 10.—Three ovisacs of adult female *in situ*. × 4.

Fig. 11.—Ovisac of adult female at the period when the female entirely fills it (dorsal). × 20.

Fig. 12.—Underside of the same showing the four respiratory channels filled with a white waxy secretion. × 20.

Fig. 13.—Ovisac of adult female after the death of the insect, the desiccated body of which is indicated by the brown colour of the anterior portion of the test. × 20.

Fig. 14.—Secretionary covering of the second-stage female. × 25.

Fig. 15.—Marginal fringe of the same, highly magnified.

Pl. LXII, fig. 1.—Adult female after treatment with potash (ventral). × 35.

Fig. 2.—Abdominal extremity of the adult female. × 140.

Figs. 3, 3*a*.—Marginal compound or figure-of-8 spinnerets of adult female. × 600.

Fig. 4.—Dorsal tubular spinnerets of adult female. × 600.

Fig. 4*a*.—Dorsal compound figure-of-8 spinnerets. × 600.

Fig. 5.—Anal orifice of adult female. × 600.

Fig. 5*a*.—Rudimentary antenna of adult female. × 600.

## [Asterolecanium orchidearum (Westwood).

In the 'Gardener's Chronicle' of 20th December, 1879, Prof. Westwood described an insect under the

above name. On carefully studying the description and the excellent figures which he gives I have come to the conclusion that the species which he had before him was the curious fringed aphis, *Cerataphis lataniæ* of Boisduval. Dr. D. Sharp, who has, jointly with Miss A. Embleton, paid considerable attention to the synonymy of this remarkable coccid-like insect, informs me that he has "obtained satisfactory proof that Westwood's insect *is Cerataphis lataniæ*." To complicate matters Westwood added to his illustrations Signoret's * figure of the larva of *Asterolecanium aureum*, which, needless to say, has nothing to do with the insect in question.]

## Genus Dactylopius † (Costa).

(Plates LXIV, LXV, and LXVI.)

To this genus belong the destructive coccids known as "mealy bugs;" two of the most characteristic species being *Dactylopius citri*, Risso, and *D. longifilis*, Targ.-Tozz. In these insects the body of the female is clothed with a thick, white, mealy secretion, but leaving the segmentation distinct; and the margins of the body are furnished with a series of equidistant, white, waxen appendages, which are longer at the anal extremity than at the sides. In *D. walkeri*, Newst. (Pl. LXV, fig. 1 *a*), the marginal appendages coalesce at the sides and in front, those of the latter forming a large projecting mass sometimes equalling half the length of the insect. *D. pulverarius*, Newst. (Pl. LXVI, fig. 4), and *D. hibernicus*, Newst., are only slightly "mealy," and there are, apparently, no caudal or marginal appendages. The three first-named species are active up to the period of parturition, when they secrete their loose, cottony, or flocculent ovisacs, but do

* 'Essai,' p. 74, pl. i, fig. 17.
† See Appendix.

not envelope themselves in the material. The females of the remaining British species are more or less stationary, remaining behind the leaf-sheaths of their food-plants, where they envelope themselves in their ovisacs.

In the exotic species there is remarkable diversity of design in the construction of the ovisac. Thus in the Australian species *D. albizziæ* (Mask.) and *D. hibbertiæ* (Mask.), it takes the form of a pad or cushion beneath the insect. The New Zealand *D. globulus* (Mask.) completely envelopes itself in a large globular mass of secretion, while *D. obtectus*, Mask., another New Zealand insect, shelters itself beneath a bud-scale of its food-plant, attaching it to its body and also to the twig by a cottony secretion; beneath this borrowed covering the insect lives and lays its eggs; thus both are highly protected and extremely difficult to locate.

The secretionary covering of the females of some of the exotic species also differs considerably from that of the typical forms. Thus, for example, *D. nipæ*, Mask., originally described from Demerara, is clothed with thick, yellowish-white plates, arranged somewhat as in *Orthezia;* and the European *D. glacialis*, Newst., clothes itself with long silken filaments.

The last-named insect is a subterranean species found associated with ants; and so also are *D. formicarius*, Newst. (India), and both Maskell's New Zealand species, *D. arecæ* and *D. poæ*.

The normal generic characters of this genus are as follows :—

Female.—Antennæ of eight joints, the last joint being almost invariably longer than the penultimate; mentum biarticulate; legs persistent; anal lobes small or rudimentary; anal orifice with six hairs.

Male.—Abdomen furnished with two long white caudal filaments; genitalia short.

Male puparium felted.

Synopsis of Species.

**A.** Adult females active up to the period of parturition. Margin of body with white waxen appendages.

*a*. Caudal appendages short.

(I) . . . . CITRI.

*b*. Caudal appendages long. Cephalic appendages separated.

(II) . . . LONGISPINUS.

*bb*. Cephalic appendages not separated.

(III) . . . . WALKERI.

**B.** Adult females more or less stationary. Margins of body without waxen appendages.

*a*. Dermis with lineal squamose structures.

(IV) . . . . HIBERNICUS.

*b*. Dermis without squamose structures.

(V) . . . PULVERARIUS.

*D. theobromæ*, Douglas, is not included in this table for reasons stated hereafter.

## Dactylopius citri * (Risso).

(Pl. LXIV, figs. 1–11; Pl. LXVI, figs. 1–3.)

*Dorthesia citri*, Risso; Essai sur l'histoire nat. des Orangers, etc., Paris (1813); Berlese, Le Cocciniglie Italiane, p. 7 (1893).

*Coccus citri*, Boisduval; Essai sur l'Ent. Horticole, p. 348, fig. 48 (1867).

*Dactylopius citri* (Boisd.), Signoret; Essai, p. 346, pl. vi, figs. 2 *a*, *b*, *c* (1875).

*Dactylopius destructor*, Comstock; Report,† 1880, p. 342, pl. xi, fig. 3; pl. xxii, fig. 2.

*Dactylopius brevispinus* (*ex p.*) (Targ.-Tozz., 1881); Berlese, l. c.

* See Appendix.

† Published 22nd November, 1881.

Adult female (Pl. LXIV, fig. 1) slightly elongate-ovate; covered with white mealy wax, except at the articulation of the segments, where the colour of the body shows through. Marginal appendages equal in length, and equidistant; outer caudal pair of appendages about ten times longer than those at the margin; inner caudal pair very short and placed closely together, scarcely longer than those at the margin. Antennæ (Pl. LXIV, fig. 2) long, of eight joints; the second, third, and sixth much the longest; all the joints with fine long hairs; formula 6, 3, 2, 1, 5 (4, 6, 7). Legs longer than the antennæ, hairy; tarsus much shorter than the tibiæ; digitules to claw and tarsi simple. Mentum (Pl. LXIV, fig. 4) long and somewhat pointed; basal joint much the shortest. Anal lobes (Pl. LXIV, fig. 3) faintly indicated, each bearing one long and two minute hairs, a ventral group of spinnerets, and two short spines, the latter being situate at the base. Anal orifice with six comparatively short hairs. Dermis with many long hairs and numerous spinnerets; and there are small groups of spinnerets (Pl. LXIV, fig. 6) surrounding a pair of short spines, and outside each group a pair of short hairs equidistantly placed all round the margin of the body, indicating the position of the marginal waxy appendages.

Long, 2–3·50 mm.

Male (Pl. LXIV, fig. 7) reddish-brown, farinose; legs and antennæ paler; eyes and ocelli black; wings with an intense blue iridescence. Caudal filaments long and rather stout. Antennæ (Pl. LXIV, fig. 9) of ten joints, of which the third and tenth are longest; all the joints rather thickly clad with fine hairs, those on the apical joint, two of which are very faintly clubbed, being the longest. Legs thickly set with fine hairs; digitules to claw extremely short and rarely traceable; those of the tarsi ordinary. Genital armature (Pl. LXIV, fig. 8) shaped somewhat like the stern of a boat and protected by a broad outer

valve. Caudal setæ very long. Puparium of the male narrowly elongate, formed of loosely felted white filaments.

Male pupa, first stage (Pl. LXV, fig. 10), pale reddish-brown, with the margins of the head and thorax continuous with the body; wing-sheaths not developed.

Male pupa, second stage (Pl. LXIV, fig. 11), similar in colour to that of the first stage. Wing-sheaths developed, and, like those of the legs, pale and translucent.

Larva (Pl. LXVI, fig. 1) elongate-ovate, slightly narrower in front than behind. Legs and antennæ well developed. Mentum long, biarticulate; loop of rostral filaments reaching nearly to the anal orifice. Antennæ (Pl. LXVI, fig. 2) of six joints, the last equal in length to the third, fourth, and fifth together; formula 6, 1, 3 (2, 4, 5). Anal lobes (Pl. LXVI, fig. 3) somewhat prominent; otherwise they resemble those of the adult female. Anal orifice recessed, large; the hairs extending to the middle of the long central setæ of the lobes.

*Habitat.*—A destructive greenhouse pest, infesting numerous plants (see Vol. I, p. 2), and found almost everywhere throughout the British Isles. It has occurred out of doors on the ivy-clad walls of hot-houses at Kew and a few other places, but I have not known it to survive long or thrive in such situations.

*Distribution.*—Occurs almost everywhere on various cultivated and other plants, and is a great pest in the orange-growing districts of Southern Europe and elsewhere.

*Habits.*—In this country it breeds very rapidly in summer, and even in winter the females may be found in all stages. I have never met with the males, however, except in the hottest weather, when I have found them almost invariably sitting at rest with the wings folded over their backs, as male coccids usually carry them. This species is frequently attended by ants, presumably for the purpose of obtaining the honey-

dew which these insects secrete; the quantity, however, is not very great, but sufficient accumulates upon the leaves of the food-plant to set up the characteristic black fungus which invariably attends colonies of mealy-bug and other coccids.

My descriptions were made from a single colony of insects in all stages on *Abutilon*.

### Explanation of the Plates.

Pl. LXIV, fig. 1.—Adult female (dorsal). × 15.
Fig. 2.—Antennæ of adult female. × 150.
Fig. 3.—Anal lobe and anal orifice of adult female. × 150.
Fig. 4.—Mentum of adult female. × 150.
Fig. 6.—Group of spinnerets and spines on abdominal segment of adult female. × 150.
Fig. 7.—Male. × 25.
Fig. 8.—Anal segment of male with genital armature and long setæ which support the filaments. × 150.
Fig. 9.—Antennæ of the male. × 150.
Fig. 10.—Pupa, first stage. × 30.
Fig. 11.—Pupa, final stage. × 25.
Pl. LXVI, fig. 1.—Larva after treatment with potash (ventral). × 100.
Fig. 2.—Antenna of larva. × 250.
Fig. 3.—Anal segment of larva, showing the somewhat prominent character of the anal lobes. × 250.

### Dactylopius longispinus (Targioni-Tozzetti).

(Pl. LXIV, figs. 12–15.)

*Coccus adonidum*,* Boisduval; Essai sur l'Ent. Horticole, p. 346, fig. 47 (1867).

* Cockerell, 'Proc. Acad. Nat. Sci. Philadelphia,' 1899, p. 261, states that "there is no such thing as *Dactylopius* (*Pediculus*) *adonidum*, Linn.," and that "the name must, therefore, disappear from our lists."

*Dactylopius longispinus*, Targ.-Tozz.; A Studi sulle Cocciniglie (Mem. del Società Ital. di Scienze nat., tom. iii, n. 3) (1867). Berlese; Le Cocciniglie Italiane, p. 7 (1893).

*Dactylopius adonidum*, Signoret; Essai, p. 340, pl. vi, figs. 1–1 *d* (1875).

*Dactylopius longifilis*, Comstock; Report, 1880, p. 344, pl. xi, fig. 2; pl. xxii, fig. 1.

Adult female (fig. 12) elongate-ovate; covered with white mealy wax except at the articulation of the segments, where the colour of the body shows through. The white, waxy, marginal appendages are shortest at the sides of the anterior half; those on the posterior half gradually lengthen out, the outer caudal pair being sometimes longer than the entire length of the insect; the central caudals are very short and slightly divergent at the ends. Antennæ (fig. 13) of eight joints, the third, fourth, and eighth being the longest and of equal length; the first and the fourth to the seventh are nearly equal in length; all the joints have fine hairs; formula (2, 3, 8) (1, 4, 5, 6), 7. Legs strong; digitules to claw rather strongly dilated; those of the tarsi faintly knobbed. Anal lobes (fig. 15) faintly indicated, each bearing one long and two minute hairs and a ventral group of spinnerets surrounding two short spines. Anal orifice (fig. 15) with six rather long hairs. Marginal groups of spinnerets surrounding a pair of short spines (fig. 14) and placed within a series of fine hairs. Dermis with numerous fine hairs and simple spinnerets.

Long, 3–4 mm.

Ovisacs composed of loose, elastic fibres, and when isolated somewhat cylindrical in form, but, like those of *D. citri*, usually massed together in large numbers and quite devoid of form.

Male.—I have not been fortunate in procuring this sex in any stage; but, judging from Comstock's description (l. c.), it very closely resembles the male of *D. citri*

*Habitat* (under glass).—It affects the same kind of plant as *D. citri* (q. v.), and is equally abundant and destructive.

*Distribution.*—A common greenhouse pest in temperate regions, but occurs in the open air in Southern Europe, Africa, Ceylon, and the West Indies.

### Explanation of the Plate.

Pl. LXIV, fig. 12.—Adult female (dorsal). × 15.
Fig. 13.—Antennæ of adult female. × 150.
Fig. 14.—Marginal group of spinnerets and spines on abdominal segment of adult female. × 150.
Fig. 15.—Anal lobe and anal orifice of adult female. × 150.

## Dactylopius walkeri (Newstead).

(Pl. LXV, figs. 1–10.)

*Dactylopius walkeri*, Newstead; Ent. Mo. Mag., s.s., vol. ii, p. 164, pl. ii, figs. 7, 7 *d* (1891).

Adult female (figs. 1, 1 *a*) very elongate; pale brown; antennæ and legs paler; covered with a dense white mealy secretion which almost obliterates the segmentation; waxy marginal appendages at the sides, coalesced, forming a very irregular outline; appendage at cephalic margin occupying the whole width, broad, flat, and slightly reflexed, and sometimes equal to half the length of the entire insect; median pair of caudal appendages very short, visible only from the ventral surface; they are composed of a much finer secretion than the rest; second pair of caudal appendages often equalling the length of the body, stout and curved outwards; third pair of caudal appendages usually about one third the length of the median pair. Antennæ

(figs. 2, 2 *a*) of eight joints, the last joint being much the longest; the other joints are comparatively short and almost of equal length throughout; all the joints with several hairs; formula 8 (1, 2) (3, 4) (5, 6, 7), or 8, 2, 3, 1 (4, 5) (6, 7). Legs (fig. 3) strong, and longer than the antennæ, rather thickly set with hairs, those on the underside of the femora being unusually long; tarsi very short; digitules short and faintly knobbed. Anal lobes normal, each with a single long hair and two or three shorter ones. Anal ring with six long hairs, the intervening spaces with minute hairs. Dermis with numerous fine hairs and circular spinnerets.

Long, 2·25–4 mm.; wide, ·75–1·50.

Ovisac composed of white cottony filaments, which are more closely felted in the centre than at the exterior. The whole structure is very fragile, and can only be obtained in a perfect condition by confining the old adult insects to a small tuft of grass by means of gauze or a glass cylinder. For convenience the tuft of grass may be grown in a flower-pot, and it is best not to confine the insects until they are well matured.

Male (fig. 4) pale red-brown; antennæ and legs paler; eyes and ocelli black; head, thorax, and abdomen mealy. Abdomen long and narrow; caudal filaments a little longer than the body and rather stout. Wings narrow. Antennæ (fig. 5) unusually long and stout; hairs numerous; two of those at the apex are slightly longer than the rest, and very faintly clubbed. Legs rather long, hairy; tarsi short; digitules to claw extremely fine and short, those of the tarsi ordinary. Genital armature (fig. 7) with the penis-sheath projecting considerably beyond the outer valve, the tip being strongly recurved. Caudal setæ (fig. 7) very long.

One of the males in my collection has a very extraordinary malformed intermediate leg (fig. 8).

*Habitat.*—On *Agrostis vulgaris* and other coarse

grasses. Very common in many parts of Cheshire; and I have also met with it freely along the coast from Wolferton to Hunstanton, in Norfolk. Mr. Tomlin has taken it at Wicken Fen, and Mr. C. W. Dale has sent to me a male which he captured on the wing in a grass field at Granvilles Wooton.

*Distribution.*—Not recorded outside the British Isles.

*Habits.*—The females usually fix themselves upon the broad leaves of the grasses, but on the slightest disturbance they fall to the ground, and are then very active. At the period of parturition they wedge themselves in between the leaves in the crown of the plant (fig. 10), and there construct their ovisacs and lay their eggs. So far as I have been able to ascertain, the larvæ do not hatch until the following spring.

The males of the second stage fix themselves between the leaf-sheaths and the flowering stems (fig. 9), where, after secreting a small quantity of short, cottony material, pupation takes place. The males hatch at the end of July and during the first and second weeks in August; and all the examples I have taken in a state of nature were also hidden beneath the leaf-sheaths of the food-plant. Like the males of *D. citri*, they were very sluggish.

The large cephalic appendage to the adult female gives it a very singular appearance, and I believe that I am right in saying that no other species of *Dactylopius* is ornamented with such an enormous mass of secretion. The long hairs on the underside of the femora are also a mark of distinction, and the antennæ of the male afford another distinguishing character, being twice the length of those of *D. citri*.

The insects evidently prefer the grass plants at the foot of hedgerows, where the grass is invariably lanky and drawn. I have found them on both the north and south sides of the hedgerows in Cheshire; while those from the Norfolk coast were chiefly on coarse plants growing in little hollows among other vegetation. I should add, however, that all the males which

I was fortunate in obtaining occurred on plants fully exposed to the sun on a bank at the bottom of a well-trimmed hedge.

### Explanation of the Plate.

Pl. LXV, fig. 1.—Female natural size *in situ* on grass leaf.
Fig. 1*a*.—Adult female at period of gestation (dorsal). × 10.
Figs. 2, 2*a*.—Antennæ of adult female. × 150.
Fig. 3.—Leg of the adult female. × 75.
Fig. 4.—Male. × 25.
Fig. 5.—Antenna of male. × 75.
Fig. 6.—Tarsus and claw of male. × 150.
Fig. 7.—Genital armature of male and anal setæ (profile). × 150.
Fig. 8.—Malformed intermediate leg of male. × 150.
Fig. 9*a*.—Position of male puparium and male under leaf-sheath. Natural size.
Fig. 10.—Ovisacs in crown of grass plant. Natural size.

## Dactylopius hibernicus (Newstead).

(Pl. LXVI, figs. 7, 7*a*, 7*b*, 8, 9.)

*Dactylopius hibernicus*, Newstead; Ent. Mo. Mag., s.s., vol. vi, p. 167, figs. 1, 2 (1895).
*Dactylopius radicum* (*ex p.*), Newstead; Ent. Mo. Mag., s.s., vol. vi, p. 235, figs. 1–3 (1895); Coccidæ Brit. Isles (Ray Soc.), vol. i, p. 64.

Adult female pale reddish-pink; very elongate, extremities equally and gradually narrowed. Antennæ (figs. 7, 7*a*, 7*b*) of seven or eight joints, usually eight;

in the latter the eighth joint is much the longest; the rest are of nearly equal length; formula 8, 2, 1, 3 (4, 5, 6, 7). Legs longer than the antennæ; tarsus (fig. 8) about one third the length of the tibiæ; digitules ordinary. Mentum rather short, rounded, and with several hairs at the apex. Anal lobes rather pronounced, with several short spines and hairs, and a single long hair. Dermis at the articulations of the segments with lineal squamose structures (fig. 9), which are very distinct in stained specimens.

Long, 2–5 mm.; wide, ·25–3 mm.

Ovisac formed in the "crowns" of the food-plant, at first very loose and cottony, but old examples become more felted; it is at all times extremely thin and fragile, and as it has invariably been found attached to two or more leaves its true form has not been traceable.

Ova pale flesh-coloured at first, but changing to reddish-pink.

*Habitat.*—In the "crowns" of various grasses, and of the sea-pink (*Armeria vulgaris*, Wild). The types of *D. hibernicus* were discovered by Miss Tomlin in September, 1893, on a chalk cliff close to the sea, at Ballintoy, co. Antrim, Ireland. I found it sparingly on the Island of St. Seiriol,* or Puffin Island, Anglesey, in 1895; and fairly common, but rarely perfect, on the marshes of Ingoldisthorpe and Snettisham, in Norfolk. I have also quite recently taken it in the Western Hebrides, including St. Kilda; but so far as I was able to trace, it seems scarce, as I only obtained a few isolated examples.

*Distribution.* — Not recorded outside the British Isles.

* These specimens were described under the name *Dactylopius radicum* (l. c.). The characters which were then considered distinct were the "curiously shaped pores or glands," and the seven-jointed antennæ of the *adult* female. I now find that the former are evidently the work of a parasite; and further that individuals occur with seven to eight joints to the antennæ. I have, therefore, sunk the species, and referred the immature examples found on the roots of the above plants to *Ripersia halophila*.

### Explanation of the Plate.

Pl. LXVI, figs. 7, 7 *a*, 7 *b*.—Antennæ of adult female. × 150.

Fig. 8.—Tibia and tarsus of adult female. × 150.

Fig. 9.—Squamose structure on articulation of abdominal segments of adult female. × 250.

## Dactylopius pulverarius (Newstead).

(Pl. LXVI, figs. 4–6.)

*Ripersia pulveraria*, Newstead; Ent. Mo. Mag., s.s., vol. iii, p. 145, pl. ii, figs. 7, 7 *a*–7 *c* (1892).

Adult female (fig. 4) very elongate, cylindrical, and narrowed anteriorly; posterior extremity truncate and slightly emarginate. Colour varying from pale pink to brown. Antennæ (figs. 5, 5 *a*, 5 *b*) of six, seven, or eight joints,* usually eight. In all cases the last joint is the longest, and is furnished with two or three stout curved hairs in addition to several long slender hairs; the remaining joints are also hairy. Legs, like the antennæ, extremely short compared with the size of the insect; digitules to claw gradually dilated; those of the tarsi ordinary. Mentum rather short; loop of rostral filaments extremely short, not reaching beyond insertion of the intermediate pair of legs. Anal lobes (fig. 6) indicated by a single long hair surrounded by several spinnerets; anal orifice (fig. 6) at extremity of body, large, with six long hairs.

Long, 1·50–4 mm.

*Ovisac.*—No complete sac is formed, but the female covers herself and her eggs with a very fine white powder, which is of such a dry, fragile nature that on disturbing the insect it almost entirely disappears from

* The types were described (l. c.) as having the "antennæ of six, sometimes seven joints." Having subsequently examined a number of individuals free from parasites, I find that the usual number is eight.

her body, only a small quantity remaining attached to the food-plant.

*Larva.*—Pale yellow; elongate-ovate. Antennæ of six joints, of which the last is the longest, and equal in length to the first four together; joints one to five nearly equal in length; all with fine hairs. Loop of rostrum reaching to insertion of intermediate legs; the latter with fine hairs. Anal orifice with six hairs; lobes normal, each with a long hair.

*Habitat.*—Chiefly on *Agrostis vulgaris*, but also on other grasses. I first discovered this species at Sandiway, Cheshire, in 1891. I have also taken it freely on the Helsby Hills, in the same county, and at Chislehurst, Kent. Mr. Brockton Tomlin has obtained examples at Deal.

*Habits.*—I have occasionally found examples of young adult females actively moving about in the "crowns" of the grasses on which they feed, and Mr. Tomlin's examples were found wandering over the leaves of a specimen of *Galium*. Finally, however, the female locates herself between the leaf-sheath and the flowering stem of the grass, and there secretes the fine white powder which covers her body and her eggs. This takes place at the end of August and the beginning of September. Probably the eggs do not hatch till the following spring, but of this I have at present no proof.

*Distribution.*—Not recorded outside the British Isles.

## Explanation of the Plate.

Pl. LXVI, fig. 4.—Adult female (dorsal) from life. × 10.

Figs. 5, 5 *a*, 5 *b*.—Antennæ of adult female. × 150.

Fig. 6.—Anal segment of adult female, with lobes and anal orifice. × 150.

## Genus Pseudococcus (Signoret).

(Pl. C, fig. 1, Vol. I; Pl. LXIII, figs. 1–9.)

Adult females differing only from those of *Dactylopius* in possessing nine-jointed antennæ.

Males with four caudal filaments.

Larvæ closely resembling those of *Dactylopius*.

In the only known British species the relative length of the antennal joints in the adult female is decidedly variable. It was chiefly this which led Mr. Douglas and myself to erect the species hereafter placed as synonyms of *P. aceris*, Sign.

In the majority of species the ovisac (Pl. C, fig. 1, Vol. I) is very elongated, and composed of white felted or flocculent secretion in which the female completely envelopes itself at the period of parturition. Before the period of the formation of the ovisac the females are decidedly active, and the British species is of a wandering disposition.

### Pseudococcus aceris (Signoret).

(Pl. C, fig. 1, Vol. I; Pl. LXIII, figs. 1–9.)

*Pseudococcus aceris*, Signoret; Essai, p. 363.

*? Pseudococcus æsculi*, Signoret; Essai, p. 364.

*? Pseudococcus brunnitarsus*, Signoret; Essai, p. 366.

*? Pseudococcus mespili*, Signoret; Essai, p. 367.

*Pseudococcus ulicis*, Douglas; Ent. Mo. Mag., vol. xxv, p. 88, figs. 1, 2 (1888).

*Pseudococcus ulmi*, Douglas; Ent. Mo. Mag., vol. xxv, p. 124, figs. 1, 2 (1888).

*Pseudococcus aceris* (Sign.), Douglas; Ent. Mo. Mag., s.s., vol. i, p. 153 (with fig.) (1890).

*Pseudococcus quercûs*, Douglas; Ent. Mo. Mag., s.s., vol. i, p. 154, figs. 1–3 (1890).

*Pulvinaria ribesiæ*, Doug., ♂ only; Ent. Mo. Mag., s.s., vol. i, p. 240, fig. 3 (1890).
*Pseudococcus socius*, Newstead; Ent. Mo. Mag., s.s., vol. iii, p. 144, pl. ii, figs. 5–5 *c* (1892).
*Nec Pseudococcus aceris*, Howard; Insect Life, vol. vii, p. 235, figs. 23, 24 (1895).
*Phenacoccus* (*Paroudablis*) *socius* (Newst.), Cockerell; Entomologist, vol. xxxiii, p. 87 (1900).

Adult female (fig. 1) ovate; pale bottle-green or greenish-yellow, rarely pale brown or brown-pink; legs and antennæ pale yellow-brown or brown; segmentation distinct; mealy, with the extremely short waxen appendages at the sides often confluent and indistinct, but those at the posterior extremity are usually conspicuous. Antennæ (figs. 2, 2 *a*) of nine joints; the second is usually the longest, then the third and the ninth; the latter and the preceding joint are usually continuous in outline, or with very little constriction at the articulation (fig. 1); this form may be considered normal, but some individuals have the ninth joint dilated and widely rounded at the apex (fig. 2 *a*), and not acuminate as in fig. 2. All the joints have long slender hairs, but the hairs on the form with the dilated ninth joint are shorter and fewer than those on the normal antennæ. Legs slightly longer than the antennæ, hairy; tibia about one-third the length of the tarsus; claw (fig. 3) rather long and toothed on the underside towards the apex; digitules to claw long and dilated; those of the tarsi represented by rather short simple hairs. Mentum almost triangular in outline; articulation nearly central; there are two hairs on the broad basal joint, and several unusually long ones on the apical joint. Eyes (fig. 5) truncated, strongly chitinised at the sides. Anal segment (fig. 4) with the lobes clearly indicated but not prominent; each with three hairs of successively increased length, and several shorter ones; and there is a conspicuous group of spinnerets surrounding the base of the hairs.

Anal orifice (fig. 4) placed well within the margin. Dermis thickly set with rather long hairs and numerous simple spinnerets.

Long, 2–4·25 mm.

Ovisac of the female (Pl. C, fig. 1, Vol. I) very elongated, sides parallel, rarely straight, but often curved or contorted; white and closely felted at first, but speedily becoming brittle and ruptured; interior sometimes faintly yellowish. Where the insects are numerous on the limited surface of the gorse, the ovisacs are often massed together on the main branches, but I have never found this to be the case on other food-plants.

Male (fig. 6) smoky-brown or rich madder-brown and mealy; legs and antennæ paler; inner caudal filaments long, outer pair about half the length of the former. Wings rather large, nervure at base yellowish. Antennæ (fig. 7) of ten joints, thickly set with rather long hairs; the longest hairs on the last four joints very faintly knobbed, so faintly that the character is very difficult to trace. Legs hairy; digitules to claw apparently very short and not extending to tip of claw; those of the tarsi represented by simple short hairs.

Genital armature (figs. 8, 8 *a*) broad, and suddenly pointed; inner (?) penis-sheath very broad, with the extremity pointed and very slightly recurved. On either side of the genital armature are three long hairs, each successively longer than the other, besides several shorter hairs, all of which are surrounded by a group of simple spinnerets; the second caudal group is attached to the margin of the succeeding segment, and consists of two long and one or more short hairs, and it is also surrounded by spinnerets, as in the first group. Margins of each of the abdominal segments with a series of hairs, and there are two converging rows of shorter hairs at the extremities on the dorsum of the genitalia.

Long, 2–3 mm.

Larva bright lemon-yellow; ovate; rostral loop

extending to the last abdominal segment. Each of the segments with a stout spine, which in life is surrounded by curly plates of secretion (fig. 9). Antennæ with the last joint longer than the three preceding ones together. Tarsi much longer than tibiæ. Anal lobes in life well pronounced, distinct. The male larvæ are a little more elongated than those of the females.

Ova pale yellow or greenish-yellow.

*Habitat.*—Occurs freely on gorse (*Ulex europæus*), elm (*Ulmus campestris*), horse-chestnut (*Æsculus hippocastanum*), laburnum (*Cytisus laburnum*), oak (*Quercus robur*), hawthorn (*Cratægus oxyacantha*), and lime (*Tilia* spp.). It is less common on apple (*Pyrus*), plum (*Prunus*), mountain ash (*Sorbus aucuparia*), sweet gale (*Myrica gale*), and sycamore.

Mr. Douglas's examples on gorse were first discovered by him at Blackheath, and specimens on the same kind of food-plant were subsequently taken by Mr. E. Parfitt at Exeter in 1886–7, and later, in 1889, Mr. Parfitt found the species in the boles of some lime trees, and Mr. Douglas referred it to *P. aceris*. Douglas himself discovered the examples on elm at Brockley in May, 1886, and described them as new. In 1889 Dr. T. A. Chapman took the species on oak at Hereford. I find it very common in many parts of Cheshire, particularly in the Forest of Delamere. I have found it sparingly also at Oban in Scotland; at Alnwick, Northumberland; Norwich and outlying districts, and at Ringstead in the same county; the Cotswolds in Gloucestershire; and also at Chislehurst and surrounding districts in Kent, in which county Mr. E. E. Green has also met with it. I have received it from Stratford-on-Avon (Hodges); and Mr. T. Shepheard has collected it in all stages, on gorse, at Bournemouth.

My descriptions are taken from a single colony of insects inhabiting a laburnum tree at Chester.

*Distribution.*—In all probability it occurs through-

out Europe, but few records are at present known. The *P. aceris* of North America is probably a different species and will need a new name.

*Habits.*—The females make their ovisacs chiefly on the undersides of the thicker branches or in the bifurcations of the slender ones, rarely on the main trunk of the tree or the leaves. This is done from the beginning to the end of May, but only three or four days are occupied in the construction of the ovisac. The eggs are laid during the formation of the sac, and the larvæ hatch towards the end of June. At the end of September the males complete their active larval state and then descend to the main trunk of the tree, where, chiefly on the south side, they make their felted puparia and pass the winter. The immature females, however, hibernate in the small crevices and the bifurcations of the smaller branches of the tree, where they remain throughout the winter, without any protection but their "mealy" coat, until the first warm days in March, when they descend to the main trunk of the tree to await the appearance of the males. After copulation the females return to the branches, often quite high up, and about five or six weeks afterwards lay their eggs and die. The earliest of the males appear towards the end of March, but the majority appear in April, and I have known them to continue hatching until the end of the first week in May. I have never seen the males take flight voluntarily, but have induced them to do so by agitating them with a pin. The males under observation were most active about 9 a.m. on bright sunny days, but at noon, when the heat was greater, they seemed less active. When walking the wings are slightly opened, but not sufficiently to expose the abdomen, and the caudal filaments are usually slightly raised from the bark. The males become almost torpid during cold, wet weather, and hide away in small crevices of the bark. Many fall a prey to a small species of spider, which weaves untidy webs across the hollows of the bark; these are

fatal traps entangling any male coccids that may walk into them.

The foregoing observations were made from a large colony of the insects infesting a laburnum, which for a number of years past has been under almost daily observation. The colonies on gorse differ somewhat in habit from those found on laburnum, which I presume is due to the much more limited areas over which the insects are able to disperse themselves. Thus the male puparia on gorse are chiefly found among the spiny leaves, and the ovisacs generally on the main stems of the food-plants; but they may be found together both upon the leaves and the branches. I have not been successful in obtaining males on any other plants but the laburnum and gorse; it is, therefore, highly probable that the females are occasionally parthenogenetic.

I have carefully examined examples of Mr. Douglas's types, and have also re-examined my own, and have come to the conclusion that we have been relying too much on the antennal formula of the adult females, which, like that of the antennæ of many other coccids, is given to variation, and cannot be, as hitherto, implicitly relied upon in the differentiation of species. The forms described by Mr. Douglas and myself as distinct species are undoubtedly all specifically the same, and I think I have correctly referred them to Signoret's *P. aceris*. As to the American *P. aceris*, it is evidently quite distinct from the European species, and will, as already stated, require a new name.

## Explanation of the Plates.

Pl. C, fig. 1, Vol. I.—Insects (ovisacs) natural size *in situ* on gorse. From a photograph.

Pl. LXIII, fig. 1.—Adult female at period of gestation (dorsal). × 10.

Figs. 2, 2*a*.—Antennæ of adult female. × 140.

Fig. 3.—Leg of the adult female. × 140.

Fig. 4.—Anal lobe and anal orifice of the adult female. × 140.
Fig. 5.—Eye of the adult female. × 140.
Fig. 6.—Male. × 25.
Fig. 7.—Antenna of the male. × 140.
Fig. 8.—Genital armature of the male (dorsal). × 140.
Fig. 8*a*.—The same (semi-profile). × 140.
Fig. 9.—Marginal spine of the larva, with waxen plates radiating from the base. Highly magnified.

## Genus Ripersia* (Signoret).

External characters of the adult females resembling those of *Dactylopius*. Antennæ of six joints, or rarely of five or seven. Anal lobes normally very small or rudimentary, but in the aberrant species, *R. terrestris*, Newst., and *R. halophila*, Hardy, these organs are abnormally large. Legs persistent. Habits chiefly subterranean.

Males unknown.

Male puparium felted.

All the species are more or less mealy, and many have marginal appendages, but they are usually very short, and, as a rule, are only present at or towards the anal extremity. Both Cockerell's *R. fimbriatula* and his *R. salmonacea* have a fringe of cottony tassels all round the body; but the most abnormal species in this respect is *R. filicicola*, Newst. (Pl. LXVII, figs. 1, 9). In its early stage this insect very closely resembles *Dactylopius citri*, but at the period of parturition it becomes stationary, and then secretes, from the margins of its body, bundles of extremely long and exceedingly delicate iridescent filaments, which, when examined under the microscope, appear very much like spun glass. A few species are known to construct more or

* See Appendix.

less compact ovisacs, within which the female encloses itself, the largest known ovisac being that of *R. tomlinii*, Newst. (Pl. LXVIII, fig. 1).

More than thirty species have been recorded from various parts of the world, including Europe, North Africa, New Zealand, Australia, and North America. Nearly all the species have been found associated with ants, chiefly of the genera *Lasius* and *Tetramorium*. According to Mr. Smith's observations on the New Zealand coccids found associated with ants, the latter almost invariably establish their nests on sites already occupied by root-feeding coccids. Some species of ants manifest the greatest care for the coccids, while others have, apparently, little regard for them. In Vol. I, p. 21, I have already called attention to the interdependence of these insects, and referred to Mr. Smith's paper; and I have also added hereafter some information on the British species.

### Synopsis of Species.

**A.** Anal lobes of adult female very small or rudimentary.

*a.* Ovisac with long, radiating, iridescent filaments.

(I) . . . . FILICICOLA.

*b.* Ovisac somewhat pyriform, felted.

(II) . . . . TOMLINII.

*c.* No definite ovisac.

(III) . . . SUBTERRANEA.

**B.** Anal lobes of adult females large, chitinised.

*a.* Antennæ of adult female with five joints.

(IV) . . . . TERRESTRIS.

*b.* Antennæ of adult female with six joints.

(V) . . . . HALOPHILA.

## Ripersia filicicola (Newstead).

(Pl. LXVII, figs. 1–12.)

*Ripersia filicicola*, Newstead; Ent. Mo. Mag., s.s., vol. ix, p. 96, fig. 10 (1898).

Adult female (fig. 1) rather short ovate, and slightly attenuated posteriorly. Colour pale ochreous yellow or red-pink; farinose, with broad, irregular, waxy appendages on the margin of the abdominal segments; there is a continuation of waxy appendages along the rest of the margin, but they are narrow and more or less continuous; caudal appendages long, narrow, and divergent. When the old adults become stationary, as represented in the figure, they secrete a quantity of long, slender, glassy, iridescent filaments, which radiate from the sides of the body, but do not appear to be attached to it, and they remain indefinitely after the formation of the sac (fig. 9). Form, after treatment with potash, elongate-ovate (fig. 2). Antennæ (figs. 3, 3 *a*) and legs comparatively large for the size of the insect. The former consist of six joints, the sixth being the longest; the third is usually the next longest, but in some examples (fig. 3) the second joint equals the third in length; all the joints have fine hairs. The tarsi and claws (fig. 7) are without clubbed hairs, simple fine hairs taking their places. Mentum (fig. 6) biarticulate, long, rather narrow, and pointed, apical joint nearly twice the length of the first; filaments very short. Anal lobes (figs. 4, 4 *a*) more or less rudimentary. Anal orifice (fig. 4) with six very long hairs, almost reaching as far as from the tips of the long hairs to the anal lobes. Dermis above with short fine hairs and spinnerets, which are more numerous at the margins of the abdominal segments, and each segment has, at the margin, a single, very short spine; the dermis between the antennæ (fig. 5)

is thickly set with hairs and spinnerets, and there are two or three pairs of spines at the margin. Spiracles (fig. 8) rather long, with the flange comparatively small.

Long, 1–2 mm.

Sac of the female (fig. 12) narrowly elongated and much attenuated at the extremities; composed of rather loose but toughish white fibres. The iridescent filaments at the sides change in time to a delicate pale blue colour. The early stage of the ovisac is shown at fig. 9, with portions removed revealing the sub-lying insect.

Long, 2–2·50 mm.

Puparium of the male (fig. 11) similar to that of the female, but attenuated only at the posterior extremity. A quantity of delicate pale blue glassy filaments project from the sides. It is much smaller than the sac of the female.

Pupa (fig. 10) slightly active. Colour yellowish-pink, or bright flesh-colour. Eyes black. Wing-sheaths long and as fully developed as those in the corresponding stage of *Dactylopius citri*.

*Habitat*.—On fronds of a West Indian filmy fern (*Trichomanes spicatum*). It was discovered by the Director of the Royal Gardens, Kew, on the 27th of January, 1897, since which time it has not been observed, nor has it been recorded from any other part of the world.

This species is remarkable for the singularly beautiful iridescent filaments secreted by the adult female, and the delicate pale blue glassy filaments secreted by the male, previous to the formation of the ovisac and puparium respectively.

Fragments of a male were found, but these unfortunately were too much broken to serve any scientific purpose, which is much to be regretted.

With the exception of the six-jointed antennæ there is nothing in either of the stages of this coccid which differentiates it from a true *Dactylopius*.

### Explanation of the Plate.

Fig. 1.—Adult female with cephalic extremity partly hidden beneath the brown epidermal scales of the fern, and with the glassy filaments at the sides, which are secreted before the formation of the ovisac. × 15.
Fig. 2.—Adult female after treatment with potash (ventral). × 20.
Figs. 3, 3 *a*.—Antennæ of adult female. × 250.
Fig. 4.—Anal extremity of adult female (ventral). × 140.
Fig. 4 *a*.—Anal lobe of adult female (dorsal). × 140.
Fig. 5.—Dermis at cephalic extremity. × 250.
Fig. 6.—Mentum of adult female. × 140.
Fig. 7.—Tarsus of adult female. × 250.
Fig. 8.—Spiracle of adult female. × 250.
Fig. 9.—Early stage of the ovisac of the adult female with portions removed, revealing the female within. × 120.
Fig. 10.—Pupa (? second stage). × *circa* 40.
Fig. 11.—Puparium of male. × *circa* 30.
Fig. 12. Insects (ovisacs and puparia) natural size *in situ* on frond of *Trichomanes spicatum*.

## Ripersia tomlinii (Newstead).

(Pl. LXVIII, figs. 1–10.)

*Ripersia tomlinii*, Newstead; Ent. Mo. Mag., s.s., vol. iii, p. 146, pl. ii, figs. 6, 6 *a*–6 *c* (1892); s.s., vol. iv, p. 77 (1893).

Adult female dull orange-yellow, farinose. Form, after restoration with potash, elongate-ovate. Antennæ (figs. 2, 2 *a*), of which there are two distinct forms, of seven joints; in fig. 2 the third joint is the longest, and the articulation of the sixth and seventh is faint,

and probably fused; while in fig. 2 *a* the seventh joint is the longest, the third is shorter than the second, and all the articulations are very pronounced. Legs, like the antennæ, small for the size of the insect; tibiæ with two spiny hairs at the apex; digitules (fig. 4) to claw and tarsi not knobbed. Anal lobes (fig. 5) indicated by one very long and one short hair. Anal orifice (fig. 5) with six long hairs reaching to the posterior margin. Eyes in the form of a truncated cone. Mentum (fig. 3) biarticulate; basal joint about equal in length to the apical one; apex rounded and furnished with hairs. Spiracles (fig. 6) rather long, with a comparatively large trumpet-shaped flange. Dermis between the antennæ (fig. 7) with a few short hairs; there are also fine short hairs and minute spinnerets on the rest of the body.

Long, 2–3 mm.; wide, 1·25–2 mm.

Sac of the female (fig. 1) usually pyriform or peg-top shaped, one end being distinctly pointed; there are also both elongate and globular forms; pyriform examples, 3–4 mm. long; elongate examples, 1·50–3 mm. long; globular examples averaging 3 mm. in diameter.

Larva (fig. 8) pale orange-yellow, strongly farinose. Form very elongate. Antennæ (fig. 10) comparatively large; of six joints, all with fine hairs; the last joint much the longest; the third, fourth, and fifth the shortest, and equal in length; formula 6, 2, 1 (3, 4, 5). Rostrum long, resembling that of the adult female; loop of rostral filaments extending beyond insertion of intermediate legs. Legs long; digitules to claw and tarsi without knobs (?). Anal lobes (fig. 9) indicated by one long and one short hair. Anal orifice (fig. 9) with six long hairs.

Ova pale yellow at first, but they darken prior to hatching.

*Habitat.*—In the nest of the black ant (*Lasius niger*), at Portland. They were taken by Mr. H. K. St. John Donisthorpe, in April, 1901. This, at present, is

the only known habitat for this species in Great Britain.

*Distribution.*—Common at Moulin Huet, Guernsey, where it was first discovered by Miss Tomlin on grass roots in an ant's nest, September, 1891. Mr. W. A. Luff, who has taken much interest in this species, informs me that it is not uncommon there, and that it is associated with *Tetramorium cæspitum*. He has also found the coccid at Alderney, but in that locality it was associated with *Lasius alienus*, and Mr. Luff "particularly noted that the coccids were found only under stones covering ants' nests, and in many instances were some distance down the holes leading to the interior of the nest. When I loosened a coccid from the grass root to which it was attached the ants carried it off into the interior of the nest; and in two instances I saw several ants loosen a coccid themselves and carry it away. Even portions of the sac which I had broken off would be eagerly seized on and carried off."

## Explanation of the Plate.

Pl. LXVIII, fig. 1.—Ovisacs of the female, natural size.

Figs. 2, 2*a*.—Antennæ of adult female. × 250.

Fig. 3.—Mentum of adult female. × 250.

Fig. 4.—Tarsus of adult female. × 250.

Fig. 5.—Abdominal lobe and anal orifice of adult female. × 250.

Fig. 6.—Spiracle of adult female. × 250.

Fig. 7.—Dermis, at cephalic margin, of adult female. × 250.

Fig. 8.—Larva (ventral). × 80.

Fig. 9.—Anal extremity of larva. × 250.

Fig. 10.—Antenna of the larva. × 250.

## Ripersia subterranea (Newstead).

(Pl. LXVIII, figs. 11–17.)

*Ripersia subterranea*, Newstead; Ent. Mo. Mag., s.s., vol. iv, p. 79, figs. 1–4 (1893).

Adult female dark red-brown, changes to dark purple in caustic potash. Form in life slightly pyriform, narrowed in front, and distinctly segmented. Antennæ (figs. 11, 11 *a*) constantly of six joints, the last being much the longest; and the joints are furnished with fine hairs; formula 6, 3, 2, 1 (4, 5). Legs, like the antennæ, comparatively short; claw and tarsi without clubbed hairs. Mentum (fig. 12) long and somewhat pointed at apex, which has several fine hairs. Spiracles (fig. 16) with a narrow flange. Anal orifice (fig. 14) with six comparatively short hairs. Anal lobes (fig. 14) indicated by one long and one short hair. Hairs on dorsum between the antennæ (fig. 15) very long and slender.

Long, 1·50–2·50 mm.; wide, 1–1·50 mm.

Second-stage female ovate, extremities nearly equally rounded, convex above; segmentation distinct, and thickly farinose; anal extremity with two very short, white, waxy appendages, but these are frequently wanting. Colour dark red-brown, legs yellowish.

*Habitat.*—On roots of *Nardus stricta* in the nests of *Formica flava*, on the raised shingle beach at Ingoldisthorpe, near King's Lynn, Norfolk, where I discovered them in August, 1892.

*Habits.*—The females are apparently viviparous or ovoviviparous, as all the old adult examples contain well-developed larvæ. All the examples occurred on the roots of the grass just below the crowns of the plants (fig. 17), where they had secreted little patches of mealy powder. All the plants harbouring the coccids were found growing in ants' nests; none were found on grass roots in any other situation. Strange

to say, the ants did not take the slightest notice of the coccids, although I placed specimens of the latter amongst them and watched them most carefully. I remember that the day in question was a dull and somewhat stormy one, which may have made the ants less attentive to their unwilling (?) lodgers than they, under more favourable climatic conditions, would have been.

This species has not been recorded from any other part of the world. As will be seen from the detailed drawings on Pl. LXVIII, it closely resembles *R. tomlinii*, but is easily distinguished from that species by its six-jointed antennæ, longer mentum, and shorter hairs on the anal orifice; it is also smaller, and, so far as I have been able to ascertain, does not construct a felted ovisac.

### Explanation of the Plate.

Pl. LXVIII, figs. 11, 11*a*.—Antennæ of adult female. × 250.

Fig. 12.—Mentum of adult female. × 250.

Fig. 13.—Tarsus of adult female. × 250.

Fig. 14.—Anal orifice and lobe of the adult female. × 250.

Fig. 15.—Marginal hairs, on dorsum between antennæ, of adult female. × 250.

Fig. 16.—Spiracle of adult female. × 250.

Fig. 17.—White secretion of the adult females on roots of grass from ant's nest. Natural size.

## Ripersia terrestris * (Newstead).

(Pl. LXIX, figs. 1–7.)

*Ripersia terrestris*, Newstead; Ent. Mo. Mag., s.s., vol. vi, p. 213, figs. 1–5 (1895); Journ. Roy.

* See Appendix.

Hort. Soc., vol. xxvi, p. 746, fig. 314 (1902); Coccidæ Brit. Isles, vol. i, p. 63.

*Rhizæcus (?) terrestris* (Newst.), Cockerell; Proc. Acad. Nat. Sciences Philadelphia, 1899, p. 265.

Adult female (figs. 2–4) greenish-yellow, but so covered with a fine mealy powder as to appear quite white (fig. 4); anal extremity with two very short waxy appendages. Form very elongate, sides parallel, gradually narrowed towards the posterior extremity, rounded in front; segmentation distinct. Antennæ (figs. 5, 5*a*) geniculated, of five joints, of which the fifth equals in length the second, third, and fourth together, and possesses three or four (usually three) long, curved, or falciform, blunt spines; all the joints have fine hairs. Legs (fig. 6) strong, with many fine hairs; tarsi and claws without knobbed hairs; all the coxæ are supported by a strong epimeron (fig. 6*a*). Mentum biarticulate, and very long; apical joint longest; filaments (fig. 2) rather stout, loop reaching midway between the intermediate and posterior legs. Anal lobes pronounced, owing in a great measure to the position of the anal orifice, which is much recessed; they are furnished with long hairs. Dorsal dermis thickly set with fine hairs, which are much the longest at the margins; there are also equidistant groups of usually three simple spinnerets along the margin, and there is a similar series along the dorsum. On the cephalic region of the dorsum, immediately over the base of the mentum, are two large eye-shaped glands; and there are two others of the same character towards the anal extremity. Ventral dermis with fewer and finer hairs.

Long, 1–2·25 mm.; wide, ·50–1 mm.

Young adult female much smaller than the adult, but differing in none of its structural details, except that the anal lobes are slightly more pronounced.

Long, ·50–1 mm.

Ova (fig. 7) translucent, white, and farinose, laid

in a quantity of loose, curly, woolly filaments secreted by the parent insect.

*Habitat.*—On the roots of stephanotis, palms, and adiantum, under cultivation under glass. It was found on the two first-named plants in the London district by Mr. Chas. O. Waterhouse early in the year 1895; those on adiantum roots at Dublin in 1901.

In my original description (l. c.) I stated that the anal lobes of the adult female were small and normal; having a longer series before me, I now find that this is not the case, and that the lobes of the old adult are almost as strongly pronounced as those of the young adults; but, as already stated, this somewhat abnormal character is much more strongly emphasized than it otherwise would be by the deeply-seated anal orifice.

The habits of the species have already been dealt with in Vol. I, p. 63, of this work.

### Explanation of the Plate.

Pl. LXIX, fig. 1.—Insects and ovisacs natural size *in situ* on roots of adiantum.
Fig. 2.—Adult female after treatment with potash (ventral). × 35.
Fig. 3.—Adult female after treatment with potash (dorsal). × 35.
Fig. 4.—Adult females from life (dorsal). × 10.
Figs. 5, 5*a*.—Antennæ of adult female. × 250.
Fig. 6.—Leg of the adult female. × 250.
Fig. 7.—Ova with part of ovisac removed. × 25.

## Ripersia halophila* (Hardy).

(Pl. LXIX, figs. 8, 8 *a*, 9.)

*Coccus halophilus* (Hardy), Signoret; Essai, p. 454.
*Dactylopius radicum* (*ex p.*), Newstead; Ent. Mo.

* See Appendix.

Mag., s.s., vol. vi, p. 235, figs. 1–3 (1895); Coccidæ of the British Isles, vol. i, p. 64 (1901).

*Ripersia halophila* (Hardy), Cockerell; Bull. Ill. St. Lab. Nat. Hist., vol. iv, p. 325 (1896).

Adult female closely resembling *Ripersia terrestris*, pure white, with two waxen appendages at the caudal extremity. Antennæ (figs. 8, 8 *a*) geniculated and constantly of six joints; formula (1, 6), 3 (4, 5), 2; all the joints have fine short hairs, and the apical joint has at least two falciform spines. Legs (fig. 9) longer than the antennæ and very strong; coxæ supported by a strong epimeron (fig. 9) which is embedded in the cuticle; tibiæ and tarsi with spiny hairs, tibiæ with two spiny hairs at apex, and there are two similar spines on the underside of the tarsi. Mentum about equal in length to the anterior femur, biarticulate; basal joint about one third the length of the apical joint, the latter with about four hairs at the margin of the apical half; loop of rostral filaments extending to insertion of intermediate legs. Anal lobes not very pronounced in well-macerated examples, furnished with long hairs and several spines. Anal orifice with six long hairs, which project considerably beyond the abdominal extremity. Segments above with numerous hairs, which are more plentiful and longer on the terminal abdominal segments, those at the margins being the longest; there is also one anterior and one posterior pair of eye-like glands.

Long, 1 mm.

It is only quite recently that I have satisfied myself that this minute species is not the immature form of *Dactylopius radicum* (now a synonym of *D. hibernicus*), under which name I at first described it, and to which I have referred the insect in Vol. I of this work. I was led to this error through finding both species living together on the same plants. It is only after a long search that I have been able to discover old adult

females, and these have enabled me to definitely fix the true characters of the species.

Unfortunately I cannot find where it was that Hardy described his *Coccus halophilus*. All that Signoret (l. c.) says of it is: "Elle est à peine de $\frac{1}{4}$ de ligne, ovale, d'un blanc opaque, sans écaille dure, mais abondamment fourni d'une matière blanche. Elle se trouve près de Fast Castle (Angleterre), au milieu des racines du *Ligusticum scoticum* et du *Rhodiola rosea*, ainsi que sur celles du *Statice armeria*, dans les rochers escarpés près de Siccar-Point." He also states that he has copied the names of the plants, and that *Rhodiola* should be *Radiola*. I assume that *R. rosea* is a synonym of *R. linoides*, Gmel., and *Statice armeria* a synonym of *Armeria maritima*, Willd.

*Habitat.*—On the roots of various grasses, heath (*Erica cinerea*), and also the above-named plants. It was rediscovered by me in June, 1895, on the Island of St. Seiriol, or Puffin Island, Anglesey, North Wales, at the roots of *Armeria maritima*. I have since found it abundantly on grass roots in loamy or sandy soil at Ince, Cheshire; and on several of the islands in the Western Hebrides, including the extremely isolated St. Kildan group (Hirta). On the latter group the insects occurred on roots which had penetrated among the stones and into the rock fissures, chiefly at an altitude of about 1000 feet; but I have little doubt that they also occurred there at a much lower level, as I found them at Lochmaddy and on other parts of the Hebrides within a few feet of the sea. I believe it to be a general feeder, but it does not seem to be associated with ants as are most other subterranean coccids.

*Habits.*—Like the preceding species (*R. terrestris*), the colonies of insects secrete a quantity of white and very fragile cottony material which eventually becomes more or less pulverulent and breaks up on the slightest disturbance; that which remains attached to the rock-surfaces has a slight bluish tinge. Before the secretion is disturbed it has much the appearance of the

fine white mycelium commonly found in turf from loamy soils, to which I have already called attention (Vol. I, p. 64), also giving some hints on the treatment of these coccids when found infesting pot-plants.

### Explanation of the Plate.

Pl. LXIX, figs 8, 8*a*.—Antennæ of adult female. × 250.

Fig. 9.—Leg of the adult female. × 250.

## Genus Eriococcus (Targioni-Tozzetti).

(Pl. LXXI, figs. 1–16.)

The normal characters of this genus are: Adult female elongate or short ovate; segmentation more or less distinct; dorsum or margin usually spiny. Antennæ of six or seven joints. Legs persistent. Anal orifice with six or eight hairs. Anal lobes conspicuous.

Ovisac of female usually elliptical or elongate, more or less convex, felted, and either with or without a minute opening at the anal extremity.

Puparium of male resembling that of the female, but much smaller.

Males winged, or rarely apterous.

The British representatives of this rather extensive division are all typical species, and therefore afford all the salient characteristics of the genus. About fifty species have been described from various parts of the world, of which no less than twenty-one are peculiar to Australia. There is evidently a great variation in the form of the ovisac in this genus, but more especially so in the Australian representatives. Thus the ovisac in *Eriococcus eucalypti*, Mask.,* is described as yellowish or reddish-brown, or brown, but covered with a number

* Ext. 'Trans. N. Z. Inst.,' 1891, p. 27.

of small white glassy tubes usually directed longitudinally, which give it often a peculiar clean and bright appearance when viewed under a lens. One of the most singular ovisacs is that of *E. cypræformis*, Fuller, which is described* as resembling a snake-head or cowrie shell, particularly when at all old or bleached. Mr. Claude Fuller (l. c.) also describes another quite unusual form of ovisac (*E. tricarinatus*) having three longitudinal ridges. But the most abnormal ovisac is that of *E. turgipes*, Mask., which Dr. W. W. Froggatt† says "stands out like a circular-rounded little cup, with a flattened dorsal region at the apex, which is generally open, but at other times closed. It varies in colour from white to light brown when old and discoloured, the felt of the sac being of a leathery texture, quite different from the other species."

Hempel's *E. perplexus*, one of the three species described from Brazil, makes a large fusiform sac remarkably like that of *Signoretia luzulæ* (Pl. XL, fig. 1), but differs in having the large aperture at the posterior extremity.

*E. elegans*, Fuller, is the only species known to me which does not make an ovisac. Fuller (l. c., p. 157) describes the female as "stationary, and covered above by a secretion of a number of white filaments, which are arranged in three distinct rows of well-defined, curling, pyramidal tufts;" and adds, "The species is clearly an *Eriococcus*, but the dorsal covering could never be regarded as a sac, although, as the insects affect the axils of the branch and branchlets, they are completely enveloped."

Although I have not observed any honey-dew secreted by the British representatives of this genus, I gather from Dr. Froggatt's extremely interesting paper on these insects that certain of the Australian species discharge large quantities. He says (l. c., p. 1): "Every one who has travelled about in the bush must

* 'Trans. Ent. Soc. Lond.,' 1899, pt. iv, p. 440.
† Ext. 'Agricultural Gazette, New South Wales,' Feb., 1900, p. 8, fig. 1.

have often noticed gum saplings in summer-time covered with curious eggs like little sacks, of a white or reddish-brown tint, over which the ants were running in swarms to suck up the honey-dew discharged by the enclosed insects." And in a reference to *E. coriaceus*, Mask., in which the ovisac is described as creamy white, yellow, dark orange, or even dull red, he says: "Though the sacs are naturally of the above colour, they are frequently so smothered with fumagine, caused by the honey-dew, or superfluous juice of the plant which they suck up in such quantities that they cannot retain it, but discharge it in the form of a fine spray, which falling over the bark and foliage, forms a food for the smutty fumagine, whose minute spores cover it and soon change it into a black skin."

The only species known to me which has been found associated with ants is *E. formicicola*, Newst.* This interesting species was discovered in October, 1895, at Constantine, Algeria, by the Rev. A. E. Eaton, who informs me that the coccids were "brought up by the ants after the first rain, and carried underground again within a few days when the weather became fine."

Finally the coccids leave their subterranean home and fix themselves upon the leaves of *Cynodon dactylon*, L., where they construct their ovisacs and die. Evidently, therefore, the females are partly subterranean and partly arboreal. But I can arrive at no satisfactory conclusions as to why the ants should adopt the strange habit of bringing the coccids to the surface after a heavy rain, and carrying them underground again when the weather becomes fine.

The only British species which I have seen living is *R. insignis*, Newst., but, owing to the great difficulty experienced in finding the females before the formation of the ovisac, I can offer little or no information with regard to its habits. The larvæ are easily reared, but they are of such a wandering disposition that I have

* 'Trans. Ent. Soc. Lond.,' 1897, p. 102, pl. iv, figs. 26, 27.

never been able to keep them under observation for more than a few days. Nor have I been able to discover a male in any stage.

### Synopsis of Species.

**A.** Antennæ of adult female with six joints.
*a.* Spines at margins only.
(I) . . . . INSIGNIS.
*b.* Spines almost covering dorsum.
(II) . . . . GREENI.
**B.** Antennæ of adult female with seven joints.
(III) . . . DEVONIENSIS.

### Eriococcus insignis (Newstead).

(Pl. LXXI, figs. 1–8.)

*Eriococcus insignis*, Newstead; Ent. Mo. Mag., s.s., vol. ii, p. 164, pl. ii, figs. 5–5 *b* (1891).

Adult female, after treatment with potash (fig. 3), elongate; margins with long, stout, equidistant, and closely-set spines (fig. 7), which are pointed and apparently hollow, and very probably serve as secreting organs, as in similar spines or "plates" in the *Diaspinæ*. Dermis above with fine slender hairs and numerous large circular spinnerets (fig. 8). Anal lobes (fig. 5) normal, each bearing a single long hair, two short ones, and one or more spines. Anal orifice (fig. 5) with eight very long hairs; the "ring" is punctate. Legs long; tibiæ and tarsi (fig. 6) equal in length; digitules to claw and tarsi ordinary. Antennæ (fig. 4) short, of six or seven joints, usually six, the third being nearly as long as the rest together; those possessing seven joints have the long third joint divided in the centre; normal formula 3 (2, 6), 1 (4, 5).

Long, 2–3 mm.

Ovisac of female (figs. 1, 1 *a*, marked ♀) very closely felted and tough; white at first, but changing to ochreous or pale straw-colour with age; elongate, low convex, posterior half distinctly segmented in some individuals; abdominal extremity with a very small opening.

Long, 3·50–5 mm.; wide, 1–1·75 mm.

Second-stage female (fig. 2) very elongate, slightly attenuated posteriorly, and distinctly segmented; margins with long, closely-set, glassy spines; caudal extremity with a pair of long hairs. Colour pale yellow.

Ova pale yellow or straw-colour.

Larva.—The antennæ and anal lobes resemble those of the adult insect.

Male unknown.

*Habitat.*—Chiefly on grass (*Agrostis vulgaris* and other Gramineæ), upon which I believe it feeds almost exclusively. Specimens have also been found on dock (*Rumex*), gorse (*Ulex europæus*), bracken fern (*Pteris aquilina*), and occasionally on dead sticks lying among grass. I have found it in company (on the same leaf) with *Eriopeltis festucæ* and *Signoretia luzulæ*. It is common at Ince, Cheshire, but I have found it very sparingly elsewhere in the county. It occurs on the Cotswolds between Leckhampton and Stroud; near King's Lynn; and at Orpington, Chislehurst, and Bearsted (Green), in Kent. It is by no means an abundant species, and requires a great deal of searching for.

Specimens recorded by Mr. Douglas * under the assumed name of *Eriopeltis lichtensteinii*, Sign. (previously *E. festucæ*, Sign., *nec* Fonsc.), proved to be this species (*E. insignis*), which is generically different from that described by Signoret ('Essai,' p. 183, pl. viii, figs. 3, 3 *a*–3 *f*).

*Habits.*—The ovisacs are formed towards the end of July, and the larvæ hatch in the following spring.

*Distribution.*—Not recorded outside the British Isles.

* 'Ent. Mo. Mag.,' vol. xxiv, p. 166.

### Explanation of the Plate.

Pl. LXXI, figs. 1, 1*a* (marked ♀).—Ovisacs of female natural size *in situ* on grass leaves.

Fig. 2.—Female, second stage, from life (dorsal). × 40.

Fig. 3.—Adult female after treatment with potash (ventral). × 25.

Fig. 4.—Antenna of adult female. × 150.

Fig. 5.—Anal segment of adult female (part), with anal lobe and anal orifice. × 150.

Fig. 6.—Tarsus and claw of adult female. × 150.

Fig. 7.—Marginal secreting spines of adult female. × 300.

Fig. 8.—Dorsal spinnerets. × 300.

## Eriococcus greeni (Newstead).

(Pl. LXXI, figs. 14–16.)

*Eriococcus greeni*, Newstead; Ent. Mo. Mag., s.s., vol. ix, p. 96, fig. 9 (1898).

Adult female elongate, with almost the whole of the dorsal dermis covered with large spines, but they do not form a marginal series as in *E. insignis*. Antennæ (fig. 14) rather long, of six joints, the third forming nearly one half of the entire length; formula 3, 2, 6, 1 (4, 5). Legs strong; tibiæ and tarsi (fig. 16) equal; digitules to claw ordinary; those of the tarsi apparently exist, but are broken away in all the examples before me. Anal lobes (fig. 15) normal, spinose, with one long hair at apex and two or more very short ones at the sides. Anal orifice (fig. 15) with eight very long hairs.

Long, 2·50 mm.; wide, 1·20 mm.

Ovisac of female not separable from that of *E. insignis* (Pl. LXXI, figs. 1, 1 *a*).

*Habitat.*—On grass at Budleigh Salterton, Devon. A single specimen was discovered by Mr. E. E. Green in September, 1896. All attempts to rediscover this species both by Mr. Green and myself have so far failed.

The species is easily distinguished from *E. insignis* by the spinose character of the dermis, and the larger and stronger legs and antennæ.

### Explanation of the Plate.

Pl. LXXI, fig. 14.—Antenna of adult female. × 150.
Fig. 15.—Anal segment of adult female with anal lobes and anal orifice. × 150.
Fig. 16.—Tarsus and claw of adult female. × 150.

## Eriococcus devoniensis (Green).

(Pl. LXXI, figs. 9–13.)

*Rhizococcus* (*?*) *devoniensis*, Green; Entomologist's Record, vol. viii, p. 260, pl. iii, figs. 1–4 (1896).

Adult female "reddish-purple; oval, rounded in front, narrowest and tapering posteriorly" (Green, l. c.). Antennæ (figs. 10, 10 *a*) much shorter than the legs, of seven joints, of which the third is generally slightly the longest; formula 3, 4, 2, 1 (5, 6, 7), or 4 (3, 2) (1, 5, 6, 7); all the joints, with the exception of the third, with fine short hairs. Rostrum doubtfully trimerous. Anal orifice (fig. 12) with eight comparatively short hairs, arranged in pairs. Anal lobes (fig. 12) normal, with one long terminal hair, one short hair, and several spines. Dermis above thickly set with large tubular spines, some of which are pointed, others slightly truncate (fig. 13); ventral surface with a few slender hairs and simple spinnerets.

Legs short and comparatively stout; tarsi (fig. 11) either equal to or a little longer than the tibiæ.

Long, 1·50–2·50 mm.; wide, 1–1·50 mm.

Ovisac of female (figs. 9, 9 *a*, and 9 *b*, ♀) composed of rather coarse but strongly-felted creamy white secretion; usually broadly oval, but some specimens are almost globular.

Long, 1·75–2·50 mm.; wide, 1·50–1·75 mm.

Puparium of the male "small, white, linear" (Green, l. c.).

Long, 1·50 mm.

Ova "pink or pinkish-yellow, dusted with a mealy powder" (Green, l. c.).

*Habitat.*—On *Erica cinerea*, Budleigh Salterton, South Devon. Discovered in August, 1896, by Mr. E. E. Green, who says: "My attention was first drawn to the insect by its habit of distorting the young shoots of the plant upon which it fixes itself. In many cases the terminal part of the shoot is twisted up in a rosette-shaped knot (fig. 9 *b*), enclosing one or more of the insects. Other shoots are bent at right angles at the point of irritation (see figs. 9, 9 *a*). The distortion occurs only when the insect has attached itself to the young growing parts of the plant; the older stems are not affected in the same way."

"In August, when the insects were first noticed, the female sacs were already packed with ova, the female being much shrivelled and occupying the anterior extremity of the sac. The male sacs had apparently been vacated for some time. No other stages of the insect were observed, but the white sacs of the adult insect were abundant, and widely distributed on this one species of *Erica*. Not a single example occurred on either the common heath or the 'ling' (*Calluna vulgaris*)" (Green, l. c.). I may add that several of the contorted twigs which Mr. Green kindly sent to me had neither insects nor ovisacs in them; evidently, therefore, the females do not remain fixed to one branch, but after contorting it move to another, or it is possible that the

insects are preyed upon by birds before the formation of the ovisac; otherwise one cannot account for the empty rosettes or other distorted branches which were sent to me.

*Distribution.*—Not at present known outside the British Isles.

### Explanation of the Plate.

Pl. LXXI, figs. 9–9 *b* (marked ♀).—Ovisacs of female natural size *in situ* on twigs of heath contorted by the insects; at 9 and 9 *a* the leaves have been removed in order to reveal the ovisacs; at 9 *b* the rosette of leaves, produced by the female, has not been removed, and the position of the ovisac is indicated by the ♀.

Figs. 10, 10 *a*.—Antennæ of adult female. × 150.

Fig. 11.—Tarsus and claw of adult female. × 150.

Fig. 12.—Anal segment of adult female, with lobes and anal orifice. × 150.

Fig. 13.—Spines and spinnerets of adult female. × 300.

## Genus Gymnococcus (Douglas).

Adult females naked at gestation, but partly or wholly protected at parturition. *Anal lobes* * *rudimentary.* Anal orifice with six hairs. Antennæ of seven joints. Legs persistent; *tarsi longer than the tibiæ.*

Larva with rudimentary anal lobes.* Anal orifice as in the adult female. Dorsum with rows of conical spines.

Male puparium felted.

The anal lobes in both the larvæ and adult females

* I described them as "obsolete" ('Ent. Mo. Mag.,' s.s., vol. viii, p. 12), but as they are indicated by long setæ they are more correctly described as rudimentary.

are characteristic of the Dactylopiinæ; and the insect hereafter described is, I think, correctly placed in this division of the Coccidæ.

*Gymnococcus agavium*, the type of the genus, was first referred to *Coccus*, but, owing to certain important discrepancies, Mr. Douglas* "at one time thought it might constitute the type of a new genus, under the name *Gymnococcus*." This name has since been adopted, and the genus is now a well-established one. Two species only are known; the one hereafter described was probably introduced from the Southern States of North America, which is also the home of *G. ruber*, Parrot and Ckll.,† where, in New Mexico, it was discovered "in clumps of grass hidden at the base of the stems."

### Gymnococcus agavium (Douglas).

(Fig. 6, *a–d*.)

*Coccus agavium*, Douglas; Ent. Mo. Mag., vol. xxv, p. 150, figs. 1–4 (1888).

*Coccus* (*Gymnococcus*) *agavium* (Doug.), Newstead; Ent. Mo. Mag., s.s., vol. viii, p. 12, figs. 1–4 (1897).

Adult female "short rounded-oval, a little narrower in front, smooth, without mealy or cottony covering; very convex and firm on upper side; pinky-yellowish, with some light brown specks on the back, somewhat in two longitudinal rows; beneath very soft and tumid; segmentation visible above and beneath. . . . After full gestation the insect becomes covered with loose cottony material copiously exuded from its body; under this the ovoviviparous parturition takes place as stated below" (Douglas, l. c.). Antennæ (Fig. 6, *a*) of

* 'Ent. Mo. Mag.,' vol. xxv, p. 150.

† 'The Industrialist,' 1899, p. 162.

seven joints, highly chitinous, with very distinct articulations; fifth joint with a spine; apical joint with a few short hairs. Legs short, highly chitinised; tarsi longer than the tibiæ. Mentum biarticulate. Anal lobes rudimentary, each indicated by a long seta. Anal orifice (Fig. 6, *b*) with six hairs; the chitinous portion of the "ring" in three equal parts, each separated from the other; orifice crescent-shaped as in the genus *Coccus*. Dermis (Fig. 6, *c*) above with numerous short conical spines.

Long, 2–3 mm.

"Male blackish-brown, shining; head broadly pro-

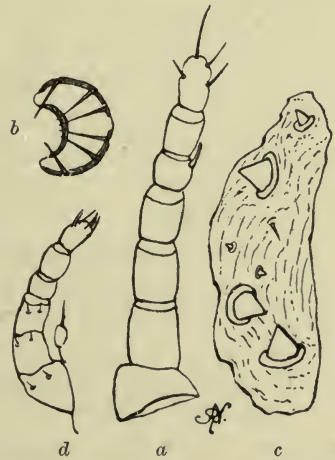



FIG. 6.—*Gymnococcus agavium*, Doug. *a*, antenna of adult ♀; *b*, anal orifice of adult ♀; *c*, dermal spines of adult ♀; *d*, antenna of the larva. (All highly magnified.)

duced anteriorly; antennæ long, slender, piceous, with projecting simple hairs; of ten joints, the first two thick, first shortest of all, narrow at base; second oval, twice as long as the last; third to fifth thinnest, third longest of all; fourth and fifth one fourth shorter, subequal; sixth to tenth stouter; sixth as long as second; seventh shorter; eighth and ninth still shorter, subequal; tenth shorter than ninth, conical. Eyes simple, and ocellus vertical, and close to the

margin of each. Thorax broad, convex, sides divergent to an angle; posterior angles prominent; posterior depression large. Wings very long, ample, clear white; halteres short, white. Terminal filaments of the body long, white. Legs long, slender, piceous, with short, projecting, simple hairs; tibiæ very long; tarsi one fourth as long as the tibiæ; claws very short. Pupa in a close-fitting sac" (Douglas, l. c.).

Long, 1 mm.

Larva with rudimentary anal lobes as in the adult. Anal orifice with six hairs. Dorsum with six rows of conical spines, not truncate as in *Coccus*. Antennæ (Fig. 6, *d*) of six joints.

*Habitat* (under glass).—The following is Mr. Douglas's account of the insect:—"In February last I received from Mr. (now Dr.) D. Morris, Assistant Director of the Royal Gardens, Kew, a quantity of white cottony matter that had been collected from the underside of leaves of a species of *Agave*, which came three years previously from one of the Southern States of North America. This mass contained many of the females of the above-mentioned *Coccus*, by which it had been produced. They were not attached to it, but on its removal they, by reason of their rotundity, rolled readily about, apparently without life. Having gummed some of them back downwards on to a card, I soon saw that they were not dead, but were in the act of extruding apparently living larvæ; but on observing them more closely with the microscope, under a half-inch objective, I witnessed some long, oval, yellow eggs extruded, from which, while in the very act of parturition, a larva escaped, so that generation is ovo-viviparous; several of the larvæ as they appeared clung together. When all were extruded, the body of the mother collapsed entirely. About a month later I obtained from Kew part of a leaf of the *Agave*, with the *Cocci* stationary *in situ* under the cotton which they had extruded, sometimes three or four under one mass. I also found, mostly on the outside of these

masses, small white cocoon-like sacs, each either empty or containing a dead pupa of the male, or in a few only a dead male imago; and although there were many of these sacs, not one had a living male in it, nor were there any living males free."

## Genus Antonina (Signoret).

Adult female apodous; anal lobes rudimentary; antennæ atrophied or rudimentary; anal orifice with six hairs.

Ovisac felted or solid and wax-like.

Larva with the *anal lobes well developed;* antennæ of six joints; anal orifice with six hairs.

This is a small genus of five or six species, represented in Europe, Asia, America, and New Zealand.*

### Antonina socialis (Newstead).

(Pl. XXXVI, figs. 1–4; Pl. XXXVII, fig. 1.)

*Antonina socialis*, Newstead; Ent. Mo. Mag., s.s., vol. xii, p. 85, figs. 10–12 (1901).

Ovisac of female usually complete, and wholly or partly hidden beneath the leaf-sheaths of the food-plant (Pl. XXXVI, fig. 1); white, elongate-ovate, flat, and closely felted, but brittle.

Long, 5–8 mm.

Adult female (Pl. XXXVI, fig. 2) viviparous, elon-

* Under date 27th August, 1897, the late Mr. Maskell wrote to me as follows:—"*Antonina purpurea*, Sign. Green writes that my *Sphærococcus bambusæ* is that species; he judges from specimens sent to him some time ago by Šulc. This is a real surprise to me, for *Antonina* is Acanthococcid! I have *one* specimen of *A. purpurea* sent by Signoret many years ago; it is not a bit like *bambusæ;* but it is not a good specimen." I record this note in order that it may not be lost. I cannot say what Mr. Green has decided with regard to the New Zealand insect, but have little doubt that he was correct in his identification of the species.

gate, about three times longer than broad; legs absent. Antennæ (Pl. XXXVI, fig. 3) of three joints, basal joint shortest, second and third of nearly equal length, the latter with five or six rather long hairs at the tip, and a single one on the first joint; articulations clearly defined. Rostrum inserted about midway between the antennæ and the anterior pair of spiracles; mentum uniarticulate; loop of rostrum not extending beyond the centre of the space between the spiracles. Posterior pair of spiracles (Pl. XXXVI, fig. 4) about midway between the extremities; anterior pair midway between the former and the cephalic margin. Anal orifice (Pl. XXXVII, fig. 1) with six long stout hairs lying within a trough-shaped cavity; anal lobes indicated by three or four long hairs. Dermis above with circular spinnerets which increase in number towards the margins of the abdominal segments, those at the posterior extremity becoming gradually longer and more numerous.

Long, 4–8 mm.

Larva.—Antennæ of six joints, of which the sixth is much the longest; formula 6 (1, 2, 3, 4, 5). Anal lobes well developed and furnished with several spines. Anal ring with six hairs, recessed from the margin.

*Habitat.*—Living in company with *Aclerda japonica*, Newst., under the leaf-sheaths of a bamboo (*Arundinaria japonica*), under glass, Broxbourne, Herts, on freshly imported plants. Received from the Editor of the 'Gardener's Chronicle,' Dr. Maxwell T. Masters, 26th January, 1899.

The following particulars concerning the form and colour of these insects in life were made when they first reached me. Unfortunately I did not then discover that there were two species living together, and I cannot now eliminate the characters of the respective species with any certainty:—"Form distinctly elongate, cephalic portion more or less clypeate, with the margin thin and slightly produced; convex and slightly widest in the middle; the whole dorsal area present-

ing a remarkable resemblance to a grain of wheat. Colour dirty white, pale to dull ochreous, or brownish; abdominal extremity red-brown."

The comparatively long antennæ are characteristic of this species, but the members of the genus appear to be very closely allied.

### Explanation of the Plates.

Pl. XXXVI, figs. 1 *a*, *b*.—Insects natural size beneath the leaf-sheaths of *Arundinaria japonica*, in company with *Aclerda japonica*.

Fig. 2.—Adult female (ventral) after treatment with potash. × 10.

Fig. 3.—Antennæ of adult female. × 250.

Fig. 4.—One of the four spiracles of the adult female. × 600.

Pl. XXXVII, fig. 1.—Anal orifice with six long hairs lying within the "trough-shaped cavity at the posterior extremity of the body." × 600.

## Genus Apterococcus * (Newstead).

Adult female stationary, living within the ovisac. Legs persistent. Antennæ of six joints. Anal lobes rudimentary. Anal orifice with six hairs. *Mentum monomerous.*

Male apterous. *Antennæ of seven joints.*

Male puparium felted.

Larvæ resembling the female; dorsum with rows of truncate spines.

The distinguishing characters of this monotypic genus are the monomerous mentum of the female, the spiny dorsum of the larva, and the extremely aberrant form of the male (Pl. LXXII, fig. 6). Apterous males

* See Appendix.

of several genera of coccids are known, but none, I believe, are so imperfectly developed as are those of *Apterococcus fraxini*. The cephalic, thoracic, and abdominal segments of this insect are only indicated by the faintest lines, which, taken together with the short, abnormal antennæ, give it much the appearance of a coccid larva, for which I mistook the insect when I first discovered it.

### Apterococcus fraxini * (Newstead).

(Pl. C, fig. 2, Vol. I; Pl. LXXII, figs. 1–13.)

*Eriococcus fraxini*, Newstead; Ent. Mo. Mag., s.s., vol. ii, p. 165, pl. ii, figs. 6–6 *b* (1891).
*Ripersia fraxini*, *id.*, *op. c.*, s.s., vol. iii, p. 147 (1892); s.s., vol. vii, p. 57, figs. 1–4 (1896).

Adult female bright red, or orange-red; more or less globular. Antennæ (Pl. LXXII, fig. 2) of six joints, each, except the first, with a broad segment of chitin, the articulations being clear and often very broad; first segment narrowly chitinised at the base, but owing to its comparatively flexible nature its true character is not easily traced; formula slightly variable, but usually (1, 6), 2, 3, 4, 5. There is a short spiny hair on the fourth, fifth, and sixth joints, and the last one bears also four very long hairs, and there are extremely minute hairs on the first, second, and third joints. Legs (Pl. LXXII, fig. 3) short, being a very little longer than the antennæ. Anal extremity (Pl. LXXII, fig. 4) with the anal lobes indicated by a single long hair, and between them, on the margin, are two pairs of spines. Anal ring with six hairs arranged in a semicircle, slightly posterior to the inner "ring." Dermis with numerous long tubular spinnerets (Pl. LXXII, fig. 5), a few circular spinnerets, and short spiny hairs, the hairs forming transverse lines on the

* See Appendix.

abdominal segments above, a few, on the terminal segments, being longer and stouter than the others. The uniarticulate mentum rather small and somewhat pointed.

Long, ·50–·75 mm.

Sac of the adult female (Pl. C, fig. 2, Vol. I), when isolated, more or less spherical, composed of white, closely-felted, but somewhat brittle material, the largest scarcely exceeding 1 mm. in diameter. A single sac often contains two or more individuals; and as a rule the sacs are packed closely together in irregular masses quite filling the narrow crevices of the bark of the tree.

Second-stage female (Pl. LXXII, fig. 1) pale red or yellowish-red; eyes piceous. Form short ovate; segments well defined; structural details resembling those of the adult insect. The insect in its early stage is partly covered with a thin cottony secretion.

Male (Pl. LXXII, fig. 6) apterous. Bright orange-red or orange-yellow, with the last six segments of the abdomen greenish-yellow; eyes black. Head a very little narrower than the thoracic segment. Antennæ of seven (Pl. LXXII, fig. 7) joints;* first and second joints broad; the third gradually narrowed towards its articulation with the second joint; the fourth and fifth joints are also narrowed at the base, but are much shorter and less attenuated than the third; sixth very broad and long; seventh longest, obtusely pointed and strongly constricted towards the centre, and usually bearing two long and two short hairs. Legs (Pl. LXXII, fig. 8) scarcely longer than the antennæ, resembling those of the female, but stouter. Genital armature (Pl. LXXII, figs. 9, 9 *a*) extremely short, composed of three distinct parts (fig. 9, profile); the dorsal portion is much the largest, and is shaped somewhat like a short blunt claw, which is apparently

* In my original diagnosis (l. c.) I gave the number of antennal joints as eight, then mistaking the strong constriction on the terminal joint for a true articulation.

articulated to a short, rounded organ, to which is attached the penis-sheath. When exserted the latter projects slightly beyond the apex of the dorsal claw-shaped organ, and has a strongly bifid apex. When at rest the penis-sheath lies within the upper claw-shaped organ, and appears on the ventral surface as shown at fig. 9 *a*.

Pupa (Pl. LXXII, fig. 14) usually of the same colour as the male. More or less ovate and narrowed posteriorly, but varying according to the age of the individual. It bears a striking resemblance to the pupæ of certain Rhyncophorous beetles.

Larva (Pl. LXXII, fig. 10) elongate-ovate. Pale crimson-yellow, mottled with bright crimson; the latter colour being also the colour of the eyes. Dermis above with six longitudinal rows of truncate spines; two subdorsal and one marginal, on either side of the meson. Antennæ (Pl. LXXII, fig. 11) of six joints, of which the sixth is much the longest, and bears four or five long hairs and two or three shorter ones; there are also minute hairs on the third and fifth joints. Legs (Pl. LXXII, fig. 12) scarcely longer than the antennæ, with the tibio-tarsal articulation central. Anal extremity (Pl. LXXII, fig. 13) closely resembling that of the adult female; but the hairs to the anal orifice are lanceolate; and there are also two spines immediately anterior to them, which are so arranged that they appear almost continuous with the lanceolate hairs of the orifice.

Ova pink when first laid, but become mottled with reddish-crimson.

*Habitat.*—Appears to be exclusively confined to the ash (*Fraxinus excelsior*), the insects fixing themselves in the cracks and crevices of the bark of the tree, giving preference to the trunks of young trees and the smaller branches of old ones. Extremely common in many parts of Cheshire, where I first discovered the insect in August, 1890. I have found it very sparingly and extremely local in the Cotswold district between

Cheltenham and Stroud. I also discovered a few females on an old isolated tree trunk at Saxthorpe, in Norfolk; but after diligent search for it in several other places between the last-named locality and Aylsham I failed to discover it. I have also seen a few examples at Tring, King's Langley, and St. Albans, in which localities it appears to be rare; but I had not the opportunity of making long and extended search for it.

*Distribution.*—Dr. Karel Šulc has found this species in Bohemia. But I am not aware that it has been found elsewhere on the continent of Europe; and, seeing that Signoret did not meet with the insect, it is probably extremely local.

*Habits.*—In 1896 I found that the females had completed egg-laying by the 21st of May, and on the 10th of June following the larvæ were swarming. Pupation takes place in September, and the males appear early in October, and continue to emerge throughout the month and during the early part of November. At the period of fecundation the females are ovate in form, but at the period of parturition they become very tumid and almost globose. The males, which were discovered in the year 1895, are very hardy, and become active with the first gleam of sunshine. I have seen them at the end of October, after four degrees of frost, running over the sunlit bark in search of their partners as early as 8.30 a.m.; while those in shadow on the opposite side of the tree were to all appearance quite torpid. In 1895–6, when I gave particular attention to this interesting species, I found the males extremely abundant and in about equal numbers to the females.

## Explanation of the Plates.

Pl. C, fig. 2, Vol. I.—Photograph of the insects natural size *in situ* on bark of the ash.

Pl. LXXII, fig. 1.—Female, second stage, from life (dorsal). × 35.
Fig. 2.—Antennæ of adult female. × 300.
Fig. 3.—Leg of adult female. × 300.
Fig. 4.—Anal extremity of adult female. × 600.
Fig. 5.—Dorsal tubular spinneret of adult female. × 600.
Fig. 5*a*.—Simple spinneret of adult female. × 600.
Fig. 6.—Apterous male, from life (dorsal). × 35.
Fig. 7.—Antenna of the male. × 250.
Fig. 8.—Leg of the male. × 250.
Fig. 9.—Genital armature of male (profile). × 250.
Fig. 9*a*.—The same (ventral). × 250.
Fig. 10.—Larva (dorsal). × 150.
Fig. 11.—Antenna of the larva. × 600.
Fig. 12.—Leg of the larva. × 600.
Fig. 13.—Anal extremity of the larva. × 600.
Fig. 14.—Pupa, from life (ventral). × 35.

## Genus Cryptococcus (Douglas).

(Pl. LXX, figs. 1–10.)

Adult females stationary, living within a felted ovisac. Antennæ *rudimentary*. Posterior pair of legs *rudimentary;* anterior and intermediate pair *absent*. Anal lobes normal.

Larva with anal orifice as in the adult female. Antennæ of *five joints*.

This, at present, is also a monotypic genus, and it is one of the most clearly defined of all the Dactylopiinæ. The distinguishing features of the female are the extremely minute antennæ (figs. 2, 2*a*), the equally small tuberculate processes which are mere vestiges of the posterior legs (figs. 3, 3*a*), and the abnormal number of spines or hairs on the anal orifice. The salient characters of the larva (fig. 7) are the anoma-

lous five-jointed antennæ, and the number of spines on the anal orifice (fig. 10).

### CRYPTOCOCCUS FAGI (Bärensprung).

(Pl. A, fig. 2, Vol. I; Pl. LXX, figs. 1–10.)

*Coccus fagi*, Bärensprung; Zeitung für Zoologie, Zootomie, und Paläozoologie, d'Alton and Burmeister, vol. i, p. 174 (1849).
*Coccus fagi*, Walker; List of Homop., pt. iv, p. 1086 (1852).
*Pulvinaria ? fagi* (Hardy), Signoret; Essai, p. 212.
*Coccus* * *fagi* (Walker), Signoret; l. c., p. 453.
*Pseudococcus fagi* (Bärensp.), Douglas; Ent. Mo. Mag., vol. xxiii, p. 152 (1886).
*Cryptococcus fagi* (Bärensp.), Douglas; Ent. Mo. Mag., s.s., vol. i, p. 155 (1890).

Adult female (figs. 1, 1 *a*, 1 *b*, 6 *c*) hemispherical, highly convex above and comparatively flat beneath, with the anal extremity slightly curved ventrally (fig. 1 *b*); segmentation faintly indicated. Colour lemon-yellow; rudimentary antennæ and legs, spiracles, and rostrum reddish-brown. Body completely covered with a dense white secretion. Rudimentary antennæ (figs. 2, 2 *a*) composed of three more or less irregular joints; second joint generally with two short stout spines, and there is sometimes a shorter one on the first joint. First and second pairs of legs obsolete; third pair (figs. 3, 3 *a*) represented by a pair of minute tuberculate projections. Spiracles (fig. 5) large, broadest at base, where they are most highly chitinised; the rest of the integument thin and folded on one side, somewhat like the folds of a camera, with the outline curved towards the opening; within the latter is an arrow-shaped piece of chitin: many examples, however, do

* Hypothetically referred to *Pseudococcus*.

not exhibit the folded character of the integument. Mentum uniarticulate; filaments unusually long, being nearly twice the length of the body. Anal lobes obsolete, their positions indicated by a single large spine and a short stiff hair, and there are two similar hairs anterior to the anal orifice on the ventral surface. Anal orifice (fig. 4) with four spines arranged in two pairs, one pair anterior, the other posterior, and between the former are several circular glands; there is also an inner smaller chitinous ring. Dermis with minute spines, and numerous minute tubular and large circular spinnerets, the latter forming distinct transverse bands on the abdominal segments above.

Long, ·75–1 mm.

Ovisac of female, when isolated, more or less circular, highly convex, and formed of a dense white felted secretion (fig. 6). Such examples may be found where the insects are comparatively few in number: they are almost invariably fixed in the narrow crevices of the bark. Where the insects have been long established the secretion forms one homogeneous mass (fig. 6 *a*), often to a depth of five or six millimetres.

Average diameter of isolated sac about 1 mm.

Second-stage female lemon-yellow. It resembles the larva in structural details, but is much more ovate and tumid.

Male unknown.

Larva (fig. 7) lemon-yellow. Elongate-ovate, eyes large. Antennæ (fig. 8) of five joints, with the second and fifth joints slightly the longest, the latter with three long slender hairs; formula 2, 5, 1 (3, 4). Legs (fig. 9) short and stout; tibio-tarsal joints very short and about equally divided; claw long; digitules to claw and tarsi ordinary. Rostrum large; mentum uniarticulate; filaments exceeding the length of the body. Anal extremity (fig. 10, dorsal) slightly truncate; anal lobes faintly projecting but extremely minute, each with a single spine. On the ventral surface immediately beneath there is another similar but

smaller spine-bearing lobule, and there is a single long slender hair arising from the base of each of the lobes *on the ventral surface.*

Ova (see fig. 1 *b*) lemon-yellow, very large in proportion to the size of the insect, and often laid in strings of four or five together, attached end to end.

*Habitat.*—Exclusively confined to the beech (*Fagus sylvatica*). It is an abundant species, and one of the commonest and most destructive of our native coccids, and it is generally and very widely distributed throughout the British Isles. In Scotland it has been recorded from Dalkeith Park, near Edinburgh.* Dr. William Somerville, Newcastle-on-Tyne, says, "The insect is very common hereabouts, and, in fact, in most parts of the country. It does a lot of damage too, and I doubt if badly infested trees ever properly recover, unless artificially assisted by dressings similar to those used for American blight." * Ravensworth Woods, co. Durham, is also given as a locality.* In Yorkshire, Mr. J. Eardly Mason found it at Headingly, near Leeds, where I have also seen it, and I found it common in the surrounding districts. In Lancashire it occurs at Huyton and Rainhill, near Liverpool. It is everywhere abundant in Cheshire, and occurs in several localities in both Flintshire and Denbighshire. Mr. Burbidge has found it at Dublin, but I am not aware of any other Irish records. It is injurious in the woods on the estate of Lord Burton at Rangemore, Burton-on-Trent. It is common near Stratford-on-Avon (Hodges), and in the Ledbury district in Herefordshire. It occurs very sparingly in the extensive beech woods between Birdlip and Painswick in Gloucestershire, but is injurious in the Forest of Dean. In Norfolk it occurs near King's Lynn and Norwich. In Kent it occurs at Chislehurst, and Mr. Green found it in the Bearsted and Malling districts. The Rev. W. Wilks informs me that it is doing much damage to the magnificent beech trees in the eastern districts of

* Ormerod, 'Reports of Injurious Insects,' 1898, pp. 6–10.

Surrey. It is common at St. Albans, King's Langley, and Tring, and on the south coast Mr. T. Shepheard has found it common in the Bournemouth district.

Quite recently Mr. W. Cooper has written to me in reference to the extensive injury which this coccid is causing to the beech trees on the Dropmore Estate, Maidenhead, which joins Cleveden on the west. Other recently discovered localities are Lancaster, "infesting a large number of trees in the neighbourhood" (Wyatt); Hexham, "it is found here upon beech from 150 to 200 years old, and was first noticed upon them eight years ago, when they looked perfectly healthy; since then it has made steady progress, and the trees named above are now nearly dead" (Robson); Hertfordshire (exact locality not given), "it spreads rapidly, and results in the death of the tree" (Dicksons, Chester); Matlock, sparingly (Tomlin).

*Distribution.*—Probably occurs in many parts of Europe, but has not been very generally observed. It occurs in Germany (Bärensprung and Reh), and Dr. Šulc has met with it plentifully in Bohemia.

*Remedies.*—The formula recommended in Vol. I, p. 59, of soft soap and water, is an excellent wash for this pest, but its effectiveness depends entirely upon the thoroughness of its application. It must be applied with a rather long-haired scrubbing-brush, which, for convenience, may be attached to a short handle. The more thoroughly the wash is scrubbed into the crevices of the bark the more effectual will be its application. Spraying the infested trees with this or any other kind of insecticide, however strong, would have very little effect upon this insect, which is so thoroughly protected by its thick, white, waxy coat.

One of the most drastic measures with which I am acquainted is that given by my friend Mr. A. T. Gillanders,* who says: "A most interesting and successful remedial measure has been brought under

* 'Trans. Manchester Microscopical Soc.,' 1898 (original paging not given in separate copy).

my notice at Blagdon, in Northumberland. With an eighth-of-an-inch auger bore three holes at about equal distances right into the centre of the trunk, about three feet from the ground, and sloping slightly towards the root of the tree. Into these holes place as much flowers of sulphur as can be conveniently got in, and then cork them firmly up with a plug of soft wood. This should be done in the autumn, and will be found successful. It was first adopted about thirty years ago, and the trees which were then operated on are now in comparatively good condition. Prior to the experiment they were covered with the scale, were very sickly-looking, and shed their leaves prematurely.

"I must acknowledge my thanks to Sir Matthew White-Ridley, Bart., . . . for kindly granting permission to record the above treatment."

On the strength of the above recommendation Mr. Lyle Smyth, of Barrowmore Hall, near Chester, adopted the method on a number of young beech trees on his estate. I have recently (April, 1903) made an examination of the trees in question, and have also made a microscopical examination of the coccids, with the result that I find the latter still living. Whether the remedy will ultimately succeed I cannot say, but I have very grave doubts. The trees which were bored are about eighteen to twenty years old, and one of them already shows signs of decay above one of the bore-holes.

*Habits.*—The eggs are laid at the beginning of July, and the larvæ hatch in the autumn, and apparently also in the spring. On hatching from the egg the majority of the larvæ work their way under the bodies of their dying or dead parents, taking up their positions by preference in the deepest parts of the fissures in the bark, where they remain for the rest of their lives, pumping up the juices of the tree. Each individual protects or covers its body with secretion, which adds to that already secreted above them by

their parents; thus the secretion gradually thickens and spreads over the tree trunk, eventually forming a more or less continuous mass, often attaining a great thickness (fig. 6 *a*, profile). In such masses one finds the remains of many generations of females. When an insect takes up a separate abode the secretion forms a complete and approximately round sac, such sacs being commonly met with on newly infested trees, or on the branches just above the trunk of a badly infested tree. It is on the trunks of the very old trees (50 to 100 years) that the insects are found in the greatest numbers, and they probably represent the survivors of many generations which have lived, cycle upon cycle, on the same tree. The larvæ do not appear to be of a wandering habit, and comparatively few seek the fresh untenanted bark; the main branches, as a rule, are not attacked to the same extent as the main trunk. Those larvæ which wander over the tree are liable to be borne away by the wind or by birds to other trees, and this is probably the means by which fresh colonies are started.

## Explanation of the Plates.

Pl. A, fig. 2, Vol. I.—Insects *in situ* on beech bark. From a photograph.

Pl. LXX, fig. 1.—Adult female (dorsal). × 40.

Fig. 1 *a*.—Adult female (ventral). × 40.

Fig. 1 *b*.—Adult female in the act of extruding an egg (profile). × 40.

Figs. 2, 2 *a*.—Rudimentary antennæ of adult female. × 600.

Figs. 3, 3 *a*.—Rudimentary posterior legs of adult female. × 600.

Fig. 4.—Anal orifice of adult female. × 600.

Fig. 5.—Spiracle and parastigmatic glands of adult female. × 600.

Fig. 6.—Ovisacs of insects natural size *in situ* on

portion of beech bark; young colony with ovisacs more or less isolated.

Fig. 6 *a*.—An older colony representing many generations with the ovisacs crowded together and overlying each other. Natural size, in profile.

Fig. 6 *b*.—A few more or less isolated ovisacs *in situ*. × 4.

Fig. 6 *c*.—Upper portion of ovisacs removed, revealing a number of females and eggs and a species of Thrips, which was found *beneath* the woolly covering. × 4.

Fig. 7.—Larva after treatment with potash. × 150.

Fig. 8.—Antenna of the larva. × 300.

Fig. 9.—Leg of the larva. × 300.

Fig. 10.—Anal extremity of abdomen of larva. × 250.

### Coccinæ.

Adult females and larvæ with a non-setiferous anal orifice; anal lobes obsolete.

I have followed Maskell * in placing the single genus *Coccus* in this subdivision; other authors have included nearly the whole of the Dactylopiinæ.

### Genus Coccus,† Linnæus (Signoret).

At p. 16, Vol. I, of this work, I have referred to the "cochineal insect" (*Coccus cacti*) as having been met with on certain cultivated cacti in this country. As commonly understood this designation is correct. But the cochineal insect includes three very closely allied species which are not easily separable, viz. *Coccus cacti*, Linn., *C. tomentosus*, Lam., and *C. confusus*, Ckll. *C. tomentosus*, as designated by Signoret,

* 'Scale Insects of New Zealand,' p. 103.

† See Appendix.

Cockerell, and myself, is a much smaller insect than the species now considered to be the true *C. cacti;* but otherwise it possesses all the salient characters of the larger species, and may in every sense be considered typical of the genus and a true cochineal insect.

The genus *Coccus* is a very distinct one, and may be defined as follows:—

Adult female.—The somewhat degenerate antennæ consist of from five to seven joints, but the number varies slightly in individuals of the same species. The legs are well developed, but somewhat short. The dorsal dermis in all the species possesses truncate spines and irregularly grouped compound spinnerets as in the Diaspinæ. But the most salient feature of the female is the complete absence of hairs or spines at the anal orifice; and there is no trace whatever of the anal lobes; they are not even indicated by single hairs, as is always the case with the Dactylopiinæ.

The larva (Pl. LXXIII, figs. 11, 12) possesses dorsal truncate spines, but they are arranged in longitudinal rows. The anal orifice is also without hairs or spines, and there is no indication or trace of anal lobes.

The male is characterised by the singular two-jointed tarsi (fig. 10), which are, I believe, a unique character among male coccids.

*Coccus acaciæ*, Mask., has been removed from the genus by Mr. Cockerell * and made the type of his genus *Epicoccus*, the female of which differs from that of the true *Coccus* in having well-developed antennæ and legs, and small inconspicuous anal tubercles. The larva also possesses "prominent but small" anal tubercles, a character which at once separates it from the genus *Coccus*.

* 'Ann. Nat. Hist.,' ser. 7, vol. ix, p. 25.

## Coccus tomentosus (Lamarck).

(Pl. LXXIII, figs. 1–15.)

*Coccus tomentosus*, Lamarck, d'après Targioni; Catal. 32 (1868).
*Coccus tomentosus* (Lam.), Newstead; Ent. Mo. Mag., s.s., vol. viii, p. 75, figs. 1–7 (1897).

Adult female (fig. 1) slightly elongate-ovate; segmentation distinct. Antennæ (figs. 2, 2 *a*) very short, tapering, of six joints; first broad and flat; second often indicated by a very narrow strip of chitin; sixth longest, and furnished with three or four short hairs; all the joints are highly chitinised and widely separated. Legs (fig. 3) stout, strong, and highly chitinised; coxæ very broad; digitules to claw and tarsi simple. Mentum bimerous, but the articulation is by no means pronounced, and it often appears to be monomerous. Anal orifice (see fig. 1) a narrow lunular-shaped slit, often difficult to trace. All the segments above closely set with truncate spines (figs. 4, 4 *a*, 4 *b*) and irregular groups of compound spinnerets resembling those found in the Diaspinæ; there are also a few short, simple spines, irregularly placed and widely separated. Ventral dermis (fig. 6) with numbers of minute spinnerets and a few minute spines. At the period of gestation the female is either completely covered or rests upon a thick white cottony material, and is of a dark crimson colour.

Long, 2–2·75 mm.

Second-stage female more elongate than the adult, but in other respects it scarcely differs.

Male (fig. 7) dark crimson, with two extremely long, slender, white caudal filaments, and the body is slightly farinose or mealy. Antennæ (fig. 8, fourth and fifth joint) of ten joints, of which the first is the shortest; all the joints with several large tuberculate

spines; joints 5 to 10 with two or three long, slender, knobbed hairs; the last joint (fig. 9) has, in addition to the tuberculate spines and knobbed hairs, two or three long stout spines near the apex. Legs with a two-jointed tarsus (fig. 10), the basal joint (fig. 10 *a*) being extremely short but quite distinctly articulated, which is much more apparent when the tarsus is slightly bent upwards. Wings with the basal portions of the nervures crimson. Eyes and ocelli black.

Puparium of the male composed of a thick white felted material, elongate, with the ends equally rounded.

Larva (figs. 11, 12) dark crimson. Legs long, with many spiny hairs; digitules ordinary. Antennæ (fig. 13) much shorter than the legs, of six joints, the third and sixth being much the longest; the second the shortest and very narrow. Mentum bimerous. Anal orifice as in the adult female. Dorsum with four longitudinal rows of truncate spines (fig. 14 *a*), and the margins furnished with spines of the same character; ventral surface without spines.

*Habitat.*—On *Opuntia fulgida*, at the Royal Gardens, Kew. All the specimens were found on a plant recently imported from Arizona, and were probably freshly introduced. The discovery of this species was made in July, 1896, and I then recorded the insect as new to the list of British Coccidæ. I have since found,* however, that a species of cochineal was discovered on *Cactus cochinillifer*, Linn., in the Succulent House at Kew in the year 1827, and, judging from the small size of the insect, I do not think that I shall err in assigning it to this species. The following are the particulars given:—"We have been most obligingly favoured by W. T. Aiton, Esq., with a drawing and specimens of the insects (*Coccus cacti*)

* Curtis's 'Botanical Magazine,' N. S., vol. i, 2741, 2742, Pl. N. 2742B, figs. 8–12. The following are the references given to the illustrations:—"8. Male cochineal insect (*Coccus cacti*), natural size. 9. Two of the same magnified. 10. Female insect, natural size. 11. Two of the same magnified." 12 shows the flocculent matter natural size *in situ* on the food-plant. Much interesting matter is added with regard to the commercial history of the cochineal.

from the Royal Gardens at Kew, which we have added to our plate. Their introduction to the Royal Gardens was in the year 1814, from Martinico, by Mons. Castelneau d'Auros, late Superintendent of the Botanic Gardens on that island." As Curtis's publication (l. c.) is dated 1827, the insects had apparently been established at Kew for a period of thirteen years prior to the record here given!

*Habits.*—The females were nearly all dead when I discovered them in the month of July, but there were quantities of immature females, and I was fortunate in rearing a few males which appeared towards the end of the month. The larvæ swarmed, and were actively passing up and down the long barbed spines of the food-plant, evidently enjoying the intense heat of the midday sun.

*Distribution.*—Mexico is apparently the home of this species, but it will very probably be found wherever the food-plants are under cultivation from that region.

It is important to note that typical specimens of *Coccus tomentosus* collected by Dr. Dugès in Mexico usually possess seven joints to the antennæ, but I find the number of antennal joints to vary, and examples occur with only six joints. The British examples have all, without exception, six joints to the antennæ.

I described (l. c.) the antennæ of the adult female as having the third joint of the antennæ the longest, and the mentum as monomerous. On re-examining a number of freshly prepared specimens I find the sixth joint of the antennæ to be the longest, and the mentum bimerous. I also find that there are several tuberculate spines on the apical joint of the male antennæ.

## Explanation of the Plate.

Pl. LXXIII, fig. 1.—Adult female, as seen by transmitted light after treatment with potash, showing bands of truncate spines on dorsal surface. × 15.

Figs. 2, 2 *a*.—Antennæ of adult female. × 140.
Fig. 3.—Leg of adult female (*minus* the broad coxa). × 140.
Figs. 4, 4 *a*, 4 *b*.—Portions of dorsal dermis with truncate spines and grouped spinnerets. × 300.
Fig. 5.—Dorsal grouped spinnerets. × 600.
Fig. 6.—Ventral dermis with small spinnerets. × 300.
Fig. 7.—Male. × 35.
Fig. 8.—Fourth and fifth joints of male antenna. × 140.
Fig. 9.—Apical joint of male antenna. × 140.
Fig. 10.—Anterior tarsus of male. × 140.
Fig. 11.—Larva (dorsal). × 150.
Fig. 12.—Larva (ventral). × 150.
Fig. 13.—Antenna of larva. × 300.
Fig. 14.—Tarsus of larva. × 300.
Fig. 14 *a*.—Dorsal spine of larva. × 600.
Fig. 15.—Insects (male and female) natural size *in situ* on portion of food-plant.

### Ortheziinæ.

Males with compound eyes; abdomen furnished with a pencil of long filaments.

Adult females active; more or less covered with plates or lamellæ of waxy secretion, those at the posterior extremity of the body forming a marsupium or ovisac; antennæ of from four to nine joints; legs normal or with the tibio-tarsal joint united; anal orifice setiferous, dorsal; anal lobes absent; spiracles sometimes present on the abdomen, as well as on the ventral surface of the thoracic area.

Larvæ resembling the females in the arrangement of the cereous covering, legs, and anal orifice. Antennæ of from four to six joints.

Few forms there are among the Coccidæ that can in any way claim the title of beauty, for, like other subfamilies of the Homoptera, it is the curious and gro-

tesque rather than the beautiful which is to be found among these pernicious insects. But all the members of the Ortheziinæ are exceptions, being the prettiest and most interesting of the Coccidæ. This is due to the wonderfully symmetrical arrangement of numerous glistening white waxy plates or lamellæ which partly or wholly cover the body of the female insect (see (Pl. LXXIV, figs. 1, 2, 3 ; Pl. LXXV, figs. 1, 9, 14, 15).

The females belonging to this division are active throughout life, and carry their eggs and young larvæ in a sac or marsupium at the posterior extremity of the abdomen. When denuded of their waxy covering and macerated in boiling potash they are seen to have large tracts of strong glandiferous spines, each gland-tract indicating the position or point of attachment of the cereous plates (see Pl. LXXIV, fig. 4). The presence of abdominal spiracles in the three species of *Orthezia* hereafter described is a marked characteristic, and one which has not hitherto been observed in this sub-family of the Coccidæ. But whether these organs exist in other species of *Orthezia*, I am unable to say ; they are certainly not traceable in the newly erected genus *Newsteadia*. The antennæ in *Orthezia insignis*, Doug., are evidently ambulatory, and are moved alternately up and down as the insect progresses (see Pl. LXXV, fig. 15) ; this habit is probably attained in other species, as the antennæ are highly chitinised, and furnished with a strong apical spine.

The males, so far as are known, all possess a fascicle or pencil of delicate filaments at the extremity of the abdomen (see Pl. LXXIV, fig. 9), and the compound eyes are very large. The only male which I have been able to obtain is that of *Newsteadia* (*Orthezia*) *floccosa*, De G., in which I failed to find any trace of ocelli or of the halteres so characteristic of other male coccids.

The first stage of the male pupa in *Orthezia urticæ*, as observed in examples recently obtained for me in Greece by Mr. Brockton Tomlin, is active; the insect is completely covered with a pure white flocculent

matter, and at the anal extremity are two long, divergent, tail-like appendages. Some of the insects in this stage had formed dense white puparia on the stems of the food-plant, in which they evidently undergo their final transformations.

In *O. insignis* "the male, after the first moult, is readily distinguishable from the other sex. It becomes more elongate, and, instead of secreting compact waxy processes, envelops itself in a loose, woolly secretion. Rudimentary wings begin to appear towards the end of this stage. The pupal (or nymphal) stage is only distinguished by the presence of rather longer wing-pads, and by the greater length of the antennæ, which are then folded back along the sides of the body, extending nearly to its extremity. The pupa has long, well-developed legs, which it can use when disturbed, though it usually remains quiescent beneath its woolly covering." *

The young larvæ are naked at first, but acquire a secretionary covering before leaving the marsupium of the parent.

Only four genera or sub-genera are at present described, viz. *Orthezia* (Bosc), *Arctorthezia* (Ckll.), *Newsteadia* (Green), and *Ortheziola* (Šulc).

Mr. Cockerell † treats of his *Arctorthezia* as a "new section," and gives as the diagnosis "female with waxy secretion dense, not easily removed; wedge-shaped lamellæ in dorsal line. Boreal forms. (*O. occidentalis* and *O. cataphracta*.)" As I fail to distinguish any important structural differences in *Orthezia cataphracta* which are worthy of sub-generic rank, I have abandoned Cockerell's new division. On the other hand, I find *Newsteadia* so clearly distinct in both the larval and adult stages that I have no hesitation in adopting Mr. Green's ‡ division, which I consider entitled to full generic rank. *Ortheziola* approaches *Newsteadia*

* Green, 'Circular,' Royal Bot. Gardens, Ceylon, S. 1, No. 10, p. 86.
† 'Entomologist,' vol. xxxv, p. 114 (1902).
‡ 'Ent. Mo. Mag.,' s.s., vol. xiii, p. 284 (1902).

very closely, but the female differs in possessing only four joints to the antennæ.*

### Synopsis of Genera.

**A.** Antennæ of the adult females of eight or nine joints; legs normal; dorsum wholly or partly covered with cereous lamellæ.
Antennæ of the larvæ of six joints.
(I) . . . . Orthezia.

**B.** Antennæ of the adult female of six joints; tibio-tarsal joints united.
Antennæ of the larva of four joints.
(II) . . . Newsteadia.

### Genus Orthezia (Bosc).

Adult females partly or wholly covered with cereous plates or lamellæ; antennæ of eight or nine joints, usually eight; legs normal; spiracles (in the British species) present on the abdomen as well as on the ventral surface of the thoracic area.

Larva with six-jointed antennæ.

### Synopsis of Species.

**A.** Dorsal surface of females wholly covered by lamellæ.
*a*. Thoracic segments each with a median wedge-shaped lamella. Marsupium short. Dorsal surface flat.
(I) . . . cataphracta (2).
*b*. Thoracic segments without median wedge-shaped lamellæ. Marsupium long. Dorsal surface not flat.
(II) . . . urticæ (1).

**B.** Dorsal surface of female partly naked.
(III) . . . insignis (3).

* Šulc gives three joints to the antennæ, but he discounts the first joint and refers to it as the "frontal process."

## Orthezia urticæ (Linnæus).

(Pl. LXXV, figs. 1–8.)

*Aphis urticæ*, Linn.; Syst. Nat., 736, 30 (1767).*
*Nec Coccus floccosus*, De Geer; Mém., vii, p. 215, pl. xliv (1783).
*Orthezia characias*, Bosc; Journ. de Phys., xxiv, 171, pl. i (1784).*
*Dorthesia characias*, l'Abbé d'Orthez; *id.*, 207, pl. i, figs. 14–16 (1785).*
*Coccus dubius*, Fab.; E. S., iv, 228, 27 (1794).*
*Dorthesia urticæ*, Burm.; Handb., ii, 76, t. ii, figs. 6 and 11 (1835).*
*Orthezia urticæ*, Amy. et Serv.; Hémipt., 624 (1843). Signoret; Essai, p. 423 (*syn. partim*), pl. i, fig. 13, ♂ larva †; pl. xxi, fig. 1, head of ♂; figs. 1 *g*, *h*, *j*, antennæ of embryo and ♀ larva; fig. 1 *m*, ♂ genitalia. Douglas; Ent. Mo. Mag., xvii, p. 174 (1881); *id.*, Trans. Ent. Soc. Lond., 1881, pt. iii, p. 297, pl. xv, figs. 1–7.

Adult female (fig. 1) with "a large, thick, bilobed projection over the head; conjoined to this, on the dorsal surface of the body, are two highly projecting parallel ridges, composed of seven or eight thick, subangular, backwardly-directed, closely-overlapping plates, leaving between the ridges a deep longitudinal furrow, which, like them, extends to the end of the body. The furrow is quite regular and smooth, but at the base of the ridges on the outer side is generally a series of small supplementary scales; by these ridges the segments of the body are quite hidden. The circumferential laminæ, starting at right angles to the base of the frontal projection, somewhat narrow and

* This part of the synonymy is from Douglas ('Ent. Mo. Mag.,' vol. xvii, p. 174).
† This figure evidently represents *Newsteadia floccosa*, ♀.

rounded on their anterior margin, directed backwards, project laterally in regular succession, to a considerable extent, each lamina (on the sides) (six to seven) showing a little beyond the one immediately preceding it; the posterior ones (three on each side) being greatly elongated, sometimes curved, and lying in the side grooves of the marsupium, but not above half their length, and the terminal middle one, arising just at the anal orifice, either lying depressed in the middle groove of the marsupium or elevated at an acute angle. I am not sure if this elevation be a voluntary act on the part of the insect, nor if the lamina ever assumes the procumbent position; often it is broken off, for all the laminæ are removable with the slightest touch. The marsupium, consisting of cereous matter of a thin shell-like structure, formed (apparently) in two plates, at any rate easily separable into two, is attached at the base to the abdomen, but extends far beyond it; the lower plate convex, the upper one flattened, the space between them forming a large cavity. . . . The lower plate arises immediately behind the posterior coxæ, and is perfectly smooth; the upper plate, constituting half the apparent length of the insect, has its surface deeply channelled lengthwise, the middle channel wide and rounded out, the others (three on each side of it) narrow, the intervening divisions thin, simulating laminæ, as I previously termed them" (Douglas, 'Trans. Ent. Soc. Lond.,' l. c.). Antennæ (fig. 2) sparsely spinose, normally of eight joints; formula variable, usually 8 (2, 3), 1, 4 (5, 6, 7), or 8, 3 (2, 1) (4, 5) (6, 7); abnormal antennæ of six (fig. 2 *a*) or seven joints are not infrequent; apical spine of the last joint of the antennæ short, stout, and rather bluntly pointed. Eyes (fig. 7) comparatively small, tuberculate, and slightly recurved. Legs nearly as long again as the antennæ, strongly spinose; coxa very broad; trochanter very narrow; femur and tibia of equal length; tarsus two thirds the length of the tibia; claw rather long, acute. Ventral spiracles

(fig. 4) large, circular, exterior thickly set with minute glandiferous spines; marginal abdominal spiracles (fig. 5) tubular, rather long, and much smaller than the ventral series. Anal orifice (fig. 3) large, with six rather long hairs, ring broadly and regularly punctured. Gland-tracts almost continuous; glandiferous spines (fig. 6) rather long, curved, and bluntly pointed. Dermis between the gland-tracts with numerous spinnerets and a few scattered slender spines. Mentum biarticulate, basal joint shortest.

Long, 4–6 mm.

Larva, after treatment with potash, rather short ovate, and narrowed posteriorly. Gland-tracts forming transverse bands, narrowly separated; glandiferous spines like those of the adult female, but smaller. Antennæ (fig. 8) of six joints; formula usually 6, 3, 2, 1 (4, 5); the last joint is much the longest and bears an apical spine.

*Habitat.*—Douglas ('Ent. Mo. Mag.,' l. c., p. 176) says: "This *Orthezia* is not scarce in the larva state, in August and September, in many places, on various plants." The only food-plant named is *Stellaria holostea*. In July, 1895, I found the larvæ swarming on *Glaux maritima*. Old adult females, with empty marsupia, were plentiful on the same plant, and also on *Statice armeria*, grass, etc. I have not met with the species elsewhere; it is, apparently, a local insect.

*Distribution.*—Common in many parts of Europe. It is said to feed upon a large number of plants, chiefly of the orders *Urticaceæ*, *Euphorbiaceæ*, and *Labiatæ*. Miss L. E. Tomlin found it abundantly at Courmayeur, Italy, in August, 1895, chiefly on composites and labiates. Mr. Brockton Tomlin has quite recently (May, 1903) collected the species at Cape Sunium, Greece. His specimens consist chiefly of male pupæ in various stages of development.

## Explanation of the Plate.

Pl. LXXV, fig. 1.—Adult female (dorsal). × 7.
Figs. 2, 2*a*.—Antennæ of adult female, from the same individual; fig. 2 represents a typical antenna, fig. 2*a* an abnormal one. × 75.
Fig. 3.—Anal orifice of the adult female. × 150.
Fig. 4.—Ventral spiracle of the adult female. × 150.
Fig. 5.—Abdominal spiracle of adult female. × 250.
Fig. 6.—Glandiferous spine of adult female from gland-tract. × 600.
Fig. 7.—Eye of the adult female. × 75.
Fig. 8.—Antenna of the larva. × 150.

## Orthezia cataphracta (Shaw).

(Pl. LXXV, figs. 9–13.)

*Coccus cataphractus*, Shaw; Nat. Misc., v, pl. clxxxii (1791); Gen. Zool., vi, 194, pl. lxii (1806).
*Dorthesia cataphracta* (Shaw), Westwood; Intr. Mod. Class. Ins., vol. ii, p. 443, fig. 118, 20 (1840).
*Dorthesia chiton*, Zett.; Ins. Lap., 314 (1840).
*Orthezia urticæ*, Signoret (*syn. partim*); Essai, p. 423 (1875).
*Orthezia signoreti*, F. B. White; Scot. Nat., iv, p. 160, pl. ii, fig. 1 (1877).
*Orthezia cataphracta* (Shaw), Douglas; Ent. Mo. Mag., vol. xvii, p. 173 (1881); Trans. Ent. Soc. Lond., 1881, pt. iii, p. 299, pl. xv, figs. 8–11.
*Arctorthezia cataphracta* (Shaw), Cockerell; Entomologist, vol. xxxv, p. 114 (1902).

Adult female (fig. 9) yellowish; antennæ and legs pale piceous. The cereous covering cream-white; "the frontal node is bilobed, thick, and not much projecting; the laminæ of the circumference short, all of

equal breadth, curved under, the posterior ones only being a little longer than the others, forming altogether a raised compact border. On the back the segmentation is distinctly visible throughout, the cereous matter taking the form of each segment; the body in early life flat, afterwards distended; the segment next to the frontal node entire, the rest divided by a median impressed line, *on* which, in the first three of the divided segments, is a very small scutelliform nodule, and at the end of the line, immediately adjoining the laminæ of the circumference, is a short, somewhat elevated lamina arising at the anal orifice and projecting over them. The marsupium is short (varying in length), broad, the posterior angles rounded off; the upper surface, arising below the circumferential border, but distinctly separated from it, nearly flat, having only eight or nine slightly raised longitudinal lines; the lower surface, arising at the posterior coxæ and hiding the abdomen, convex, perfectly smooth, the end curved upwards" (Douglas, 'Trans. Ent. Soc. Lond.,' l. c.). The denuded female, after treatment with potash, is broadly ovate with the extremities equally rounded. Dorsal gland-tracts distinctly separated, broad, and forming a regular transverse series; glandiferous spines (fig. 12) comparatively short, stout, and bluntly pointed; dermis between the gland-tracts with spiny hairs and simple spinnerets. Antennæ (figs. 10, 10*a*) spinose, of seven or eight joints; formula usually (8, 1) (2, 3) (5, 6, 7) 4, or when seven-jointed 1, 7, 2, 3 (4, 5, 6). Eyes (fig. 11) very large, tuberculate, curved outwards. Mentum biarticulate, apex with several long, slender spines. Anal orifice with six long hairs; ring broadly but finely punctate. Ventral spiracles large, broadly dilated externally; abdominal spiracles (fig. 12) minute, circular, with a concentric series of spinnerets, closely surrounded by glandiferous spines. Legs somewhat sparsely spinose; coxa very broad; trochanter very narrow and of almost equal width throughout.

Long, 3–5 mm.

Male "grey-white, wings diaphanous, at the base narrow, then immediately widening on the lower side, the whole contour being a long broad oval; close to the nearly straight anterior margin is a strong raised nerve, which ends at about the middle of the length; from this, at a little distance from the base, furcates a slight nerve directed towards the inner margin, but not reaching it, and becoming evanescent at about the same distance from the base as the strong costal nerve. The antennæ slender, filiform, about one-third shorter than the wing, the articulation obscured. Head, thorax, and abdomen also obscured by a white mealy powder; from the end of the abdomen projects a divergent pencil of about twelve white hairs, which is fully as long as the whole insect. The legs are also covered with the same kind of mealy powder, and there is a trace of it on the wings. Length, exclusive of tail, $\frac{1}{2}$ line; expanse of wings, $1\frac{3}{4}$ lines" (Douglas, 'Trans. Ent. Soc. Lond.,' l. c., p. 302).

*Habitat.*—Chiefly among moss, about the bases of the stems of various grasses, *Carex*, heather, or among dead leaves and *débris* beneath moss. Often in company with *Newsteadia* (*Orthezia*) *floccosa*. Abundant on hedge-banks in shady spots, and on mountains and moors. It has been recorded from several localities in Scotland. In June, 1902, I found the species plentiful in suitable spots on many of the main islands in the Western Hebrides, including St. Kilda; and Mr. J. Macnaught Campbell, of the Kelvingrove Museum, has sent the species to me from Dalmillington, Ayrshire. Douglas ('Ent. Mo. Mag.,' l. c.) gives Ireland, but does not refer to any particular locality. Mr. Brockton Tomlin informs me that it is extremely common in co. Antrim, and has during the last three years sent examples to me from that district. It has been taken in some numbers at Bolton-le-Moors, Lancashire, by Mr. C. E. Stott; and I have found it common in many parts of Flintshire, Denbighshire,

and Carnarvonshire, and sparingly on the Cotswolds, near Cheltenham.

*Distribution.*—Greenland; Norway and other parts of Northern Europe. Cockerell gives Siberia, but does not say if in Europe or Asia.

### Explanation of the Plate.

Pl. LXXV, fig. 9.—Adult female (dorsal). × 7.

Figs. 10, 10*a*.—Antennæ of the adult female; fig. 10 represents a typical antenna, fig. 10*a* an abnormal one. × 75.

Fig. 11.—Eye of the adult female. × 75.

Fig. 12.—Abdominal spiracle of the adult female, with three of the surrounding glandiferous spines and two fine hairs. × 600.

Fig. 13.—Terminal segment of the adult female, showing gland-tracts (dorsal) and anal orifice (ventral). × 75.

## Orthezia insignis (Douglas).

(Pl. LXXV, figs. 14–18.)

*Orthezia insignis*, Douglas; Ent. Mo. Mag., vol. xxiv, p. 169 (♀ only *), figs. 1–3 ♀ (1888).

*Orthezia nacrea*, Buckton; Indian Mus. Notes, vol. iii, p. 103 (1894).

*Orthezia insignis* (Doug.), Green; Circular Royal Bot. Gardens, Ceylon; S. 1, No. 10, pp. 83–94 (1899).

Adult female (figs. 14, 15) usually dark bottle-green, very old examples becoming blackish or piceous; legs and antennæ fulvous. "Short-broad-oval, surrounded (except over the head) by a marginal series of snow-white,

* Green (l. c.) has shown that the description of the ♂ given by Douglas applies to a totally different insect. I think it is probably a species of *Dactylopius*.

laterally connected lamellæ, which, after the first three on each side, are directed backwards and downwards, gradually increasing in length, the posterior ones overhanging the marsupium; but of these the middle three are shorter and more distinct, the median one, over the middle channel, shortest and broadest of all, either turned up vertically or horizontal, and having a median sulcation; the dark surface of the body level, nude, the segmentation plainly discernible, but on the middle are two longitudinal, narrow, contiguous yet distinct lines of small, granulose, white, lamellate projections. These lines, beginning at the base of each antenna, extend backward for a short distance convergently, but almost immediately after each curves outward and again inward, so as to leave a small, dark, oval space between them; then both are parallel, and close together up to the anal extremity. Marsupium snow-white, varying in length, margins straight, parallel; the upper side shorter than the lower, longitudinally canaliculate, the median channel wide, two others on each side of it very narrow, and further down on the rounded sides are usually slight striate indications of one or two more channels; underside shining, semi-tubular, being transversely very arched, smooth, with the faintest traces of transverse indications of the progressive stages of development; posteriorly curved upward, apex truncate, but the lateral angles produced" (Douglas, l. c.). Denuded female, after treatment with potash, ovate, slightly narrowed in front, widely rounded posteriorly. Gland-tracts corresponding in position to the external cereous plates; glandiferous spines very slightly curved, bluntly pointed, and suddenly dilated at the base. Eyes comparatively small, hemispherical. Antennæ (fig. 16) spinose, of eight joints; formula 8 (3, 1) (2, 3, 4, 5), 6; apical spine strong, bluntly pointed. Mentum biarticulate; basal joint scarcely one-third the length of the apical joint; apex of the latter with several rather long spines; legs rather strongly and closely spinose,

especially the tibiæ and tarsi (fig. 17). Anal orifice with six long hairs. Abdominal spiracles tubular, small; orifice dilated.

Larva, after treatment with potash, ovate; extremities usually equally rounded. Gland-tracts forming comparatively narrow transverse bands on the abdominal segments. Antennæ (fig. 18) of six joints; apical joint equalling the length of the third, fourth, and fifth together; formula 6, 5 (1, 2) (3, 4); apical spine very long, acute. Anal orifice with six hairs; ring with a double series of punctures. Mentum biarticulate.

Male.—Green (l. c.) briefly describes the male "as a very graceful little insect . . . of a slaty-grey colour, with very long slender antennæ, a single pair of greyish wings, and a tuft of long white silky filaments at the end of the body. The eyes are black and divided into numerous facets." Mr. Green also gives an excellent figure of the male in the 'Tropical Agriculturist' for January, 1895, from which one may gather that the insect is remarkably like the male of *Newsteadia* (*Orthezia*) *floccosa* (Pl. LXXIV, fig. 9), only that the colour of the two insects is different.

*Habitat* (under glass).—"In August [1887] Mr. Edward T. Browne, Uxbridge Lodge, Shepherd's Bush, sent me several examples of this species, which he had obtained in the Royal Gardens at Kew, requesting that I would describe it if new, and he added the following particulars:—'First found on *Strobilanthes*, a Chinese plant, which has been in the Economic House three years; it may now be seen in the adjoining house on other foreign plants'" (Douglas, l. c.). Both Mr. Green and I found the species still existing at Kew in 1896; it was, at that time, most abundant on *Strobilanthes gossypinus* and *Manettia bicolor*. It may be important to add here the report * of the Assistant Curator of the Royal Botanic Gardens, Kew, with reference to the food-plants of this insect

* 'Bull. Roy. Gardens, Kew,' Nos. 102, 103, p. 163 (1895).

and its effect thereon:—"The Chinese *Strobilanthes* referred to * is *S. flaccidifolius*, Nees, . . . which was received from Hong Kong in May, 1886. This plant is not much affected by the *Orthezia*, whereas *S. gossypinus* and *S. cuspidatus*, two Indian species introduced by means of seeds received from Ootacamund in 1887, have been much subject to it, as also are other species of *Strobilanthes* from India and Ceylon. The only plants upon which the *Orthezia* appears to thrive are *Manettia bicolor* and *Streptocarpus*. No appreciable harm is done to the plants by the *Orthezia*, even when they are badly infested. It is the least harmful of all the insects parasitical on plants at Kew. It has been noticed in the tropical house for about ten years, but we cannot trace its source. . . . As far as Kew is concerned, the *Orthezia* is rather a scientific curiosity than a troublesome pest." Dr. Maxwell T. Masters, the editor of the 'Gardener's Chronicle,' has sent the species to me from the London district, on *Coleus;* and Mr. Buckton (l. c.) says that the insect "appears to be spreading over the hothouses of England, and seems to be very difficult to annihilate. It does as much mischief as the more common 'mealy bug.'"

*Habits.*—As I have had no opportunity of studying the life-history of this coccid, I venture to give Mr. Green's very interesting account of it as observed by him in Ceylon. He says: "There appears to be a constant succession of broods. I have examined infected plants at all times of the year, and have always found the insects in all stages, from the newly-hatched larva to the adult female. I have kept individual females under observation. After the first commencement of the formation of the ovisac a period of three weeks elapses before the emergence of the first larva, after which the young insects hatch out at the rate of about five a day for a period of six weeks or more, by which time the parent is exhausted and dies; and the earliest hatched larvæ are mature and

* Douglas, l. c.

commence ovipositing on their own account. The length of life of a single insect is therefore about fifteen weeks; but as it commences to produce larvæ at the ninth week, there may be five generations in the course of a year.

"This fecundity is more or less independent of the attentions of the male insects, which appear only at irregular intervals. It is doubtful whether a generation of males is produced even once a year. It is remarkable that the true male of *Orthezia insignis* has been recorded only from Ceylon. Supposed males have been described and figured both in England and America, but in both these cases the male of a totally different insect has been erroneously associated with this female. Since the appearance of this pest in Ceylon two male broods only have come under my personal observation—in July, 1894, and May, 1898. On both these occasions the male insects occurred in enormous numbers, hovering in the air like gnats, the silky tufts on their tails glistening in the sunlight. In May of the present year (1898) myriads of these little flies might be seen floating in the air in certain parts of 'Lady Horton's Walk' and other roads about Kandy. It is the female that is responsible for the chief damage, as she continues to pump up sap from the plant during the whole period of her existence. Unlike most scale-bugs, the *Orthezia* is quite an active insect, and able to change its position at will. It prefers the young shoots to the older stems, and moves upward with the growth of the plant." In England the number of broods would be regulated by the temperature of the house, and, judging from their numbers at Kew, I should imagine that two or three broods are produced in a year.

Mr. Green also gives a complete list of the known food-plants, which includes the following orders:—*Acanthaceæ*, *Rubiaceæ*, *Verbenaceæ*, *Compositæ*, *Solanaceæ*, *Labiatæ*, *Rutaceæ*, *Leguminosæ*, *Caprifoliaceæ*, *Bignoniaceæ*, *Rosaceæ*, *Amaranthaceæ*, *Ternstromiaceæ*,

*Convolvulaceæ*, and *Lythraceæ*. The insect is popularly known in Ceylon as the "Lantana bug," and in this country as the "Kew bug." The most effective remedies for this pest are the hydrocyanic-acid-gas treatment, and the kerosene emulsion given on page 57 of vol. i.

*Distribution.*—Not at present recorded from any part of Europe besides Britain. It is very generally distributed throughout the West Indies and in various districts of Mexico. In South America it has been recorded from British Guiana and Brazil. It has been observed in greenhouses in several parts of the United States. Mr. E. E. Green records it from several districts in Ceylon, where it has proved a very destructive pest; and Mr. C. P. Lounsbury says that it is a troublesome insect both in greenhouses and gardens in several localities in South Africa.

### Explanation of the Plate.

Pl. LXXV, fig. 14.—Adult female with the marsupium partly developed. × 20.

Fig. 15.—Old adult female with the marsupium fully developed, and the young larvæ hatched therefrom. × 10.

Fig. 16.—Antenna of the adult female. × 75.

Fig. 17.—Tibia and tarsus of the adult female. × 75.

Fig. 18.—Antenna of the larva. × 75.

### Genus Newsteadia (Green).

Adult female wholly covered with cereous lamellæ; antennæ of six joints; legs with the tibio-tarsal joint united.

Larva with four-jointed antennæ.

This genus is, so far as at present known, mono-

typic. It was erected by Mr. Green * so recently as December, 1902. I had long prior to this discovered the remarkable characteristics of *Orthezia floccosa*, and in consequence had decided to make it the type of a new genus. With reference to the antennæ, Mr. Green says that the "terminal joint is apparently composed of two fused joints, forming a scape-like termination; the antennæ thus consisting of seven distinct joints as opposed to eight in the other species. . . . Another remarkable character in *floccosa* is the very long basal joint of the antenna." In ascribing seven joints to the antennæ Mr. Green has evidently overlooked the true character of the third joint, which, although deeply constricted in the centre, is not articulated; the constriction, however, so exactly simulates a joint that it may be easily mistaken as such.

### Newsteadia floccosa (De Geer).

(Pl. LXXIV, figs. 1–15.)

*Coccus floccosus*, De Geer; Mém., vii, p. 604, 9, pl. xliv, fig. 26 (1778).
*Dorthesia floccosa*, Kirby and Spence; Intr. Ent., iii, p. 138.
*Orthezia normani*, Douglas; Trans. Ent. Soc. Lond., 1881, p. 300, pl. xv, figs. 12–15.
*Orthezia* (*Newsteadia*) *floccosa* (De Geer), Green; Ent. Mo. Mag., s.s., vol. xiii, pp. 284, 285 (1902).

Adult female (figs. 1–3) with the body and legs pale yellowish, darkening with age. Cereous covering pure white; "frontal node obtusely angulated, the margins usually recurved so that the middle appears sulcate; of the circumferential laminæ, the first four broad, flat, rounded on the front edge, projecting; or

* 'Ent. Mo. Mag.,' s.s., vol. xiii, p. 284.

the first three only have this character, the fourth being longer and curved outwards, the remainder narrower and straight, adhering to and not separable from the elongate canaliculation of the marsupium; of the dorsal segments, that next the frontal node has an erect angulated lamina, the next three or four have each a broad, delicate, suberect, forwardly directed lamina, which is deeply cleft, almost divided, in the middle, so that each side appears with a greatly rounded projecting edge; the other segments straight, with, at most, only a slight trace of lamination; at the anal orifice is a short lamina either lying flat or slightly elevated; the marsupium varies much in length, sometimes being only half that of the rest of the insect, and sometimes, but more rarely, as long as the other portion of the insect; the upper surface canaliculate, the under surface very convex, the end much recurved" (Douglas, l. c.). Female, after treatment with potash (fig. 4), short, ovate, or subcircular. Antennæ (fig. 5) spinose, more or less geniculate, of six joints; first joint longest and broadest; second and sixth joints nearly equal in length, each about three-fourths the length of the first; the third joint, which is equal in length to the fourth and fifth together, has a central constriction closely simulating a joint; formula 1 (2, 6), 3 (4, 5); apical spine slender, pointed. Eyes close to the antennæ (fig. 5), tuberculate, and much dilated at the base. Legs long and rather stout, strongly spinose; tibio-tarsal joint (fig. 6) either straight or faintly curved; claw short, with a pair of slender basal spines. Mentum (fig. 7) biarticulate, stout, in prepared specimens often porrected; apical joint more than twice the length of the first. Anal orifice dorsal, near the margin, with six short spine-like hairs; ring broadly punctate. Gland-tracts broad, approximate at the margins, but rather widely separated on the dorsum; marsupial tract (fig. 4 *a*) more or less cordate; glandiferous spines (figs. 8, 8 *a*, and 8 *b*) rather long, bluntly pointed, straight or more or less curved.

Long, 3–5 mm.

Male * (fig. 9) strongly farinose, more especially so at the margins of the abdominal segments. Colour brownish-yellow; margins of the chitinised portions of the thorax and legs dark brown; eyes black. Caudal tuft consisting of about sixteen individual filaments, the latter being shortest at the sides. Antennæ very long, strongly setose, the hairs in life appearing white, of ten joints; the first and second joint shortest, normal; the third to the eighth inclusive much the longest, subequal, the eighth being about two-thirds the length of the third; ninth and tenth joints together equalling the length of the eighth; formula 3, 4, 5, 6, 7, 8 (9, 10), 1, 2. Legs (fig. 10) strongly setose; tarsus about half the length of the tibia. Wings comparatively large, faintly hyaline, slightly farinose, and by transmitted light finely reticulated. Head, thorax, and abdomen setose; the hairs on the abdomen arranged in single transverse rows. Genitalia (fig. 11) large; the outer valves somewhat cheliform and finely spinose at the apex; penis-sheath porrected, with a dorsal, subapical dilation, and the apex deeply cleft.

Larva, after treatment with potash (fig. 12), short ovate, more or less attenuated posteriorly. Gland-tracts forming transverse bands, widest on the cephalic and thoracic areas, narrowest on the abdominal segments. Glandiferous spines resembling those of the adult female. Mentum (see fig. 12) very large, biarticulate, apex reaching from beyond the insertion of the posterior legs; apical joint nearly as long again as the first. Antennæ (fig. 14) geniculate, long, stout, sparsely spinose, and composed of four joints; the first is much the broadest; the second either equal to or a little longer than the first; the third much the shortest, and much narrowed at its articulation with

* My description of the male is made from examples obtained from an isolated colony of females, so that there can be no doubt as to the identity of the species.

the second; the fourth is nearly as long as the rest together, and bears one very long and one short apical spine. Legs (fig. 13) very long, stout, and sparsely spinose; tibio-tarsal joint obsolete; but there is sometimes a very faint subcentral constriction on the posterior legs; claws with a pair of short, slender, basal spines. Eyes, placed close to the antennæ (fig. 14), comparatively small. Anal orifice (fig. 15) with six rather short, stout, spiny hairs; ring broadly punctate.

*Habitat.*—Mr. Douglas, under the name *Orthezia normani* (l. c.), gives Pitlochry (Norman) and Bexley Wood, Kent, and states with regard to the latter locality that he "had the pleasure of finding this species on a bank, among the stems of grass and other plants, and dead leaves and *débris*." He also saw examples from Mr. C. W. Dale, but does not give the locality. I find the species is decidedly partial to moss and grass among heather and other plants; and it also occurs freely among dead leaves and *débris*, and on one occasion I found it in the crowns of *Helianthemum* and grass which were growing in a large ant-hill. I have found it abundantly at Chislehurst, Kent; on the extremely dry Oolitic escarpments in the Cotswolds, Gloucestershire; at Briston, Norfolk, in very damp situations; among dead fir leaves and damp moss in Delamere Forest, Cheshire, and also in very dry situations in the same county; in the moorlands of Flintshire, Denbighshire, and Carnarvonshire, North Wales; and also in the principal islands in the Western Hebrides, including St. Kilda.

*Distribution.*—Probably common in many parts of Europe, but outside the British Isles I believe it has only been authentically recorded from Germany and Bohemia (Šulc); and Mr. Luff has met with a single example at Guernsey, which he found in an ants' nest, together with specimens of *Ripersia tomlinii*.

Mr. Green (l. c.) gives the following interesting account of its occurrence in Australia:—"Mr. C.

French, Entomologist to the Victorian Department of Agriculture, has sent me examples of a coccid found 'on some wet timber at the 300 feet level in a mine in Gippsland, Australia.' A truly remarkable situation in which to find living *Coccidæ!* The insect proves to be *Orthezia floccosa*, De Geer. European examples of this species are usually found amongst wet moss or sphagnum. It is possible that they may feed either on these mosses or upon *Algæ* associated therewith. These Australian examples may have been carried down from the surface with the timber used in the mine, and may have sustained themselves upon such cryptogamic plants during their sojourn under ground. All the species of *Orthezia* appear to be able to exist for long periods without food (a characteristic found also in many *Monophlebinæ*). These same insects survived the journey by post from Australia to Ceylon, absolutely without food, and are still living in the pill-box in which they were received." Mr. Green's paper is dated August, 1902, but he does not say when the insects were despatched from Victoria or when he received them.

## Explanation of the Plate.

Pl. LXXIV, fig. 1.—Old adult female with fully developed marsupium (dorsal). × 7.

Fig. 2.—Young adult female with the marsupium (*a*) about two-thirds developed. × 7.

Fig. 3.—Dorsal view of a similar specimen. × 7.

Figs. 4 *a*, *b*.—Adult female after treatment with potash; *a*, marginal gland-tract; *b*, marsupial gland-tract. × 25.

Fig. 5.—Antenna of the adult female. × 70.

Fig. 6.—Tibio-tarsal joint of the adult female. × 70.

Fig. 7.—Mentum of the adult female. × 70.

Fig. 8.—Group of glandiferous spines of the adult female. × 150.

Figs. 8 *a*, 8 *b*.—Glandiferous spines more highly magnified. × 600.
Fig. 9.—Male. × 35.
Fig. 10.—Leg of the male. × 70.
Fig. 11.—Genitalia of the male. × 70.
Fig. 12.—Larva after treatment with potash (ventral). × 70.
Fig. 13.—Leg of the larva. × 140.
Fig. 14.—Antenna of the larva. × 140.
Fig. 15.—Anal orifice of the larva. × 600.

## Monophlebinæ.

Mr. Maskell * gives the following diagnosis of this subdivision :—"Adult females active or stationary; naked or covered with mealy, cottony, or waxy secretion; segmented; antennæ of ten or eleven joints; anterior pair of feet similar to the rest; ano-genital ring without hairs; anal tubercles inconspicuous.

"Males with faceted eyes and no ocelli."

In order to include a congeneric insect possessing seven joints to the antennæ, Mr. Maskell † subsequently modified his diagnosis of the antennal formula, making it "antennæ *usually* of eleven joints."

The principal genera included in this subdivision of the *Coccidæ* are—*Monophlebus*, *Icerya*, *Walkeriana*, *Cœlostoma*, *Callipappus*, *Palæococcus*, etc. The only representative which has been found in this country is *Icerya ægyptiacum*, Douglas.

## Genus Icerya (Signoret).

"Adult females having antennæ of eleven joints, covered with a thin mealy secretion or with cotton;

* 'Scale Insects of New Zealand,' p. 104 (1887).
† 'Trans. N. Z. Inst.,' 1892, p. 241.

stationary; with or without ovisac. Rostrum and mentum present. Segmentation inconspicuous.

"Adult males without tassels on the abdomen; antennæ with two dilations on each segment" (Maskell, l. c.).

To this genus belongs the destructive *cottony-cushion scale Icerya purchasi*, Mask., which "is supposed to have come originally from Australia. It has been very injurious to orange and lemon trees at the Cape of Good Hope and in California. In Auckland it has destroyed whole orchards of the same trees, and in Nelson and Hawke's Bay it is a dreadful pest on all kinds of plants" (Maskell, l. c.). *Icerya ægyptiacum* was at first made the type of the genus *Crossotosoma*, but the insect is now recognised as a true *Icerya*, and the name has been abandoned.

The ovisac, when present, is attached to the abdomen of the female (see Fig. 7, *b* in the text), in which respect it is similar to those of the genus *Orthezia*.

### Icerya ægyptiacum (Douglas).

(Fig. 7, *a*, *b*.)

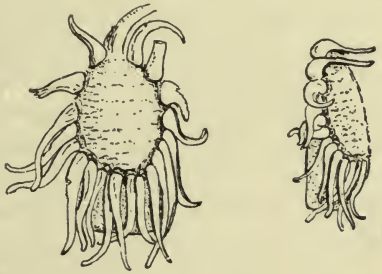
*Crossotosoma ægyptiacum*, Douglas; Ent. Mo. Mag., s.s., vol. i, p. 79, figs. 1–4 (1890).

*Icerya ægyptiacum* (Doug.), Riley and Howard; Insect Life, vol. iii, p. 97.

*Icerya ægyptiacum* (Doug.), Newstead; Ind. Mus. Notes, vol. iii, p. 7, pl. ii, figs. 2 *a–d* (1894).

Adult female (Fig. 7, *a*, *b*) "deep orange, becoming black after death; broad oval, slightly convex above. Head small, rounded in front. Antennæ black, short, stout, of eleven wide joints, with many projecting pale hairs; . . . the anterior margin of each with a pale ring. . . . Eyes black, shining, not faceted, projecting from a wide oval base in the form of a short, sub-

conical, truncate tube, of which one side is irregular, being constricted near the base; viewed in front the tube is translucent. Thoracic segments occupying nearly one-half the length of the body, strongly defined by incisions, those of the abdomen less so, but all distinctly marked. In the first stage of adultness the whole smooth surface has a pellicle of white waxen matter closely adherent, but easily detached, and often more or less rubbed off; eventually, as the ovisac is developed, exudation of waxen and cottony matter obscures the segmentation. At first there is a narrow, well-defined marginal rim all round the body; afterwards there is a flattened area exterior to this; from



*a* *b*

Fig. 7.—*Icerya ægyptiacum*, Doug., ♀ : *a*, dorsal; *b*, profile. × 5.

just below it, on each side of the abdomen, is a projecting fringe of seven to eight distinct, contiguous, stout, sinuate, tapering, waxen, snow-white, opaque, fragile processes, 3–5 mm. long, much curved round at the pointed ends, all, as a rule, tending downwards. In one specimen, sheltered within a curved leaf, a similar, but thicker, straighter, obtuse, upturned or horizontal appendage also proceeds from the sides of each of the thoracic segments, and two from the head, the latter close together, the others wide apart. . . . Close under the processes at the end of the abdomen, and reaching backwards as far as their extremities, is the white, broad, plump, posteriorly rounded, cottony ovisac; it then curves under the abdomen and com-

pletely covers the underside of it (Fig. 7, *b*), closely attached thereto at the edges, forming a capacious receptacle, quite smooth externally, but with the faintest indications of longitudinal striæ; above this the abdomen remains horizontal" (Douglas, l. c.).

Long, 5–7 mm.

Second-stage female resembling the adult insect. Antennæ of from seven to nine joints, usually eight.

Puparium of the male composed of a rather closely-felted white secretion.

Long, 2·50–3 mm.

*Habitat.*—On a freshly-imported plant at the Royal Botanic Gardens, Kew. This is the only recorded instance of its occurrence in the British Isles. When it was discovered how serious a pest this was the infested plant was promptly destroyed, and nothing further has been seen of the insect.

*Distribution.* — Douglas's types were sent from Alexandria, Egypt, in 1889, with a note that "they were causing immense injury to fruit trees." Rear-Admiral R. W. Bloomfield, R.N., has also sent specimens to me from the same locality, and writes of it "as an eleventh Egyptian plague, which made its appearance at Alexandria in 1885, and has since proved most destructive to all kinds of vegetation; origin unknown" (*in lit.* 10th September, 1892). In 1892 Miss Tomlin sent it to me from Madras, where she had found it on a purple-leaved plant very like a *Coleus*. Howard and Riley (l. c.) give some additional information as to its occurrence at Alexandria, and speak of it as causing the greatest alarm.

# APPENDIX.

PULVINARIA VITIS, var. RIBESIÆ (pages 66, 67).

THE chalcidid parasite, whose method of oviposition has been described at page 66 of this volume, has been identified by Dr. L. O. Howard, Entomologist, U.S. Department of Agriculture, as probably *Blastothrix sericea*, Dalman. He also informs me that this insect "was reared by Kollar from coccids on *Tilia* and *Prunus*, as well as on *Æsculus*, *Acer*, and *Corylus*. Rienhard and Tscheck also reared it from bark-lice on plums and on *Carpinus*. Probably all of these scale-insects belong to the *Lecanium* group. In this country we find *Blastothrix* nearly always coming from *Lecanium*, and this is the same with the comparatively few exotic species. *Blastothrix longipennis*, for example, has become rather widely distributed commercially, and is parasitic upon various species of *Lecanium*."

GENUS LECANIUM (page 75).

The members of this genus have now been referred to *Coccus*, type *C.* (*Lecanium*) *hesperidum*, Linn. In a paper "On the Type of the Genus *Coccus*, L.," Mrs. C. H. Fernald,* Amherst, Mass., U.S.A., says: "The

* 'Canadian Entomologist,' 1902 (?), p. 232. The separate pages were sent to me without any reference to volume or year, but as they reached me on September 24th, 1902, I assume that Mrs. Fernald's paper will be found in the volume for that year.

first attempt to separate the species given under *Coccus* in the tenth edition of the 'Systema Naturæ' of Linnæus, was made by Geoffroy, in his 'Histoire Abrégée des Insectes,' vol. i (1762), where he placed a part of them under *Chermes*, and left *adonidum* and *phalaridis*, with his new species *ulmi*, under *Coccus*. Of these species only *phalaridis* was given under the genus *Coccus* by Linnæus in his tenth edition, and is therefore the only species that could be regarded as the type of *Coccus* so far as Geoffroy is concerned.

"In 1802, Latreille, in vol. iii, p. 267, of his 'Hist. Nat. Crust. Ins.,' established *hesperidum* as the type of the genus *Coccus*. I have not been able to find that any of the writers between the appearance of the work of Geoffroy and that of Latreille published anything that would fix the type of *Coccus*. Leach in 1815, and Samouelle in 1819, adopted *cacti* as the type, but the statement made by Leach that it 'inhabits fruit trees' makes it quite certain that he had under consideration neither *cacti*, L., nor the cochineal insect. Samouelle merely copies Leach. Curtis, in his 'British Entomology' (1838), gives *cacti*, L., as the type; but none of these three authors could affect the question, as the type had already been established by Latreille, if not by Geoffroy, as shown above.

"The *phalaridis* of Linnæus was so obscure an insect that the author himself could not determine whether it was a *Coccus*, an *Aphis*, or a *Chermes*. Fonscolombe, in describing his *Coccus radicum graminis* ('Ann. Soc. Ent. Fr.,' iii, 212, 1834), gave the synonymy as follows: —'Phalaridis (?), Linn., Fab., non *C. phalaridis*, Enc. Méth. *nec* Geoffr.' Professor Cockerell has suggested the idea that the *phalaridis* of Geoffroy was possibly not the same species as the Linnæan insect, which is precisely the same idea that Fonscolombe had, as shown by his synonymy. Since it is probably impossible to prove that Geoffroy had any of the Linnæan species of the tenth edition in his restricted genus, the only safe ground will be to adopt the type established

by Latreille in 1802, at least till further light is obtained of the identity of *phalaridis*, L., which is at present unknown.

"If, therefore, we adopt *hesperidum* as the type of *Coccus*, the genera *Calymnatus* and *Calypticus* of Costa, and *Lecanium* of Burmeister, will fall as synonyms of *Coccus*, and a new sub-family name will have to be substituted for *Lecaniinæ* and also for the sub-family now called Coccinæ.

"The species *cacti*, L., as has been shown by Professor Cockerell, is a *Monophlebus*, and must be known by the name *Monophlebus cacti*, L."* But Cockerell, in a later publication,† refers the cochineal insect and the allied species to the genus *Dactylopius* (see *Dactylopius* in Appendix).

## Lecanium persicæ, var. coryli (page 94).

On the 3rd of April, 1903, Mr. Cockerell sent to me the following communication:—"Miss K. Fenn, Isleworth, Middlesex, sent me some Lecaniums she found at Isleworth on red currant. I sent them to Mr. George B. King, who says they are *Eulecanium rehi*, King, described from Germany. . . . . No doubt the species is the one called *L. ribis*, Fitch, in England, but it is not Fitch's species." Unfortunately Miss Fenn was unable to obtain examples for me, but I have not the least doubt that they are specifically the same as those described in this work as *L. persicæ*, var. *coryli*, Linn. *Lecanium* (*Eulecanium*) *rehi*, King, will therefore fall as a synonym.

I must here point out a grave error on my part in making Linnæus's *L. coryli* a variety of Geoffroy's *L. persicæ*, which is not permissible, seeing that the description of the latter was published sixteen years later than that of the former. As there is still some

* 'Proc. Acad. Nat. Sci. Philad.,' 1899, p. 261.
† 'Annals and Mag. Nat. Hist.,' s. 7, vol. ix, 1902, p. 453.

doubt as to whether the species found so abundantly on currant and other plants in this country is really the *Lecanium coryli* of Linnæus, I think, on the whole, it is advisable to abandon the Linnæan name altogether, and give priority to Mr. Douglas's *L. sarothamni*, of which I have examined a long series of type specimens. The amended synonymy will, therefore, be as follows:—

LECANIUM PERSICÆ, var. SAROTHAMNI (Douglas).

*Lecanium sarothamni*, Douglas; Ent. Mo. Mag., s.s., vol. ii, p. 65 (1891).
*Lecanium rehi*, King; Jahrb. der Hamb. Wissen. Anstal., xviii, p. 5 (1901).
*Lecanium ribes*, Signoret *et* Auct., *nec* Fitch.
*Lecanium persicæ*, var. *coryli* (Linn.), Newstead; Coccidæ of the British Isles (Ray Society), vol. ii, p. 94 (1903).

## GENUS DACTYLOPIUS (page 162).

Mr. Cockerell * now refers the commercial cochineal and the allied species to this genus. He says:—"Through the kindness of Mr. C. D. Sherborne and Mrs. C. H. Fernald I have been able to obtain full particulars regarding this genus, which has been altogether misunderstood by authors. *Dactylopius*, Costa ('Fauna del Regno di Napoli,' vi, p. 15), was founded on two species—*D. coccus*, Costa, and *D. polonicus*. The latter belonged to the already founded genus *Margarodes*. The former, which is the first mentioned, is to be regarded as the type of the genus. *D. coccus* is said to be *Coccus cacti*, L., but instead of being a synonym of that species (*Monophlebus cacti* †), it is the first available name for the commercial cochi-

* Cockerell, 'Annals and Mag. Nat. Hist.,' s. 7, vol. ix, 1902, p. 453.
† Cockerell, 'Proc. Acad. Nat. Sci. Philad.,' 1899, p. 261.

neal. The identity of *D. coccus* with the cochineal is thoroughly established by the fact that there is a short Latin description coming before the citations of synonymy, while there follows later a full account in Italian."

## Genus Pseudococcus (page 176).

"This name must evidently be used for the genus called *Dactylopius* by authors. It was based on the common mealy-bug and the cochineal—the latter being, as we have just seen (see *Dactylopius*), already provided with a generic name. The species first cited by Westwood is *Coccus adonidum*, and it is evident from the context that he meant the mealy-bug, *C. adonidum*, etc., of Geoffroy (see also 'Spon's Encycl.,' vol. i, p. 699, 1882). I have not been able to find where *Trechocoryx*, Curtis (cited as a synonym by Berlese), was published, but suppose that it was later than *Pseudococcus*" (Cockerell, 'Ann. Nat. Hist.,' ser. 7, vol. ix, 1902). Should this change remain valid, *Phenacoccus*, Ckll.,* must be substituted for those insects hitherto placed in *Pseudococcus* of Signoret and other authors, but not of Westwood.

## Genus Ripersia (pages 182, 190, 192).

Of the five species described in this work, *R. terrestris* and *R. halophila* are, as already pointed out, aberrant species. Cockerell (see reference, p. 191) doubtfully refers *terrestris* to the genus *Rhizæcus* of Künckel, and states that it "has in common with *Rhizæcus falcifer* (Künck.) the peculiar elongate shape, the five-segmented antennæ, the elongated mentum, and the prominent caudal tubercles. . . . The terminal segment of the antenna has not

* Cockerell, 'Entomologist,' vol. xxxiii, p. 87.

the curious falciform spines observed in *R. falcifer* and *eloti*." With reference to the falciform spines, I have already shown that these organs do exist in *Ripersia terrestris*. I have not seen Künckel's description of *Rhizæcus*, but it is evident from what Mr. Cockerell says of it that *Ripersia terrestris* possesses an antennal formula like that of *Rhizæcus*. I do not, however, see the necessity for adopting *Rhizæcus*, more especially so as *Ripersia halophila*, a very closely allied species, possesses the normal antennal formula as found in the typical species of *Ripersia*.

### Apterococcus fraxini (page 210).

Mr. Cockerell * gives priority to *Fonscolombia fraxini* (Kalt.), and says that "this insect was first described by Kaltenbach in 1874. In 1895 Nitsche proposed for it the sub-generic name *Pseudochermes*. Newstead, when describing it as new, used the same specific name as that of Kaltenbach." As I have not been able to see Kaltenbach's description of his *F. fraxini* I am not prepared either to accept or to dispute Mr. Cockerell's claim to Kaltenbach's priority.

### Genus Coccus (page 221).

The species of cochineal placed so long in the genus *Coccus* are now referred, by Mr. Cockerell, to *Dactylopius* (see *Dactylopius* in Appendix).

* 'Proc. Acad. Nat. Sci. Philad.,' 1899, p. 264.

## GLOSSARY OF TERMS.

(Compiled largely from that of Mr. E. E. Green's 'Coccidæ of Ceylon,' pp. vii–x.)

*Abdomen.*—All the hinder part of the insect posterior to the thorax.

*Anal cleft.*—A deep incision in the females of the *Lecaniinæ* extending from the anal orifice.

*Anal lobes.*—A pair of more or less prominent appendages of the abdominal segment placed over or near the anal orifice.

*Anal ring.*—A chitinous ring, usually bearing hairs, encircling the anal orifice.

*Antennæ.*—A pair of jointed organs or "feelers" situated on the head.

*Apodema.*—A broad transverse band crossing the thorax in front of the scutellum in male coccids.

*Apodous.*—Without legs.

*Apterous.*—Without wings.

*Atrophied.*—Imperfectly developed.

*Biarticulate.*—Having two joints.

*Carina.*—A ridge.

*Caudal.*—Pertaining to the posterior extremity.

*Cephalic.*—Pertaining to the head.

*Cereous.*—Composed of wax, or wax-like.

*Chitin.*—A hard tegumentary substance somewhat resembling horn.

*Chitinised.*—Hardened by the deposition of chitin.

*Chitinous.*—Consisting of chitin.

*Circumgenital glands.*—Circular spinnerets disposed in groups around the genital orifice.

*Cornicle.*—A short blunt horn or rounded protuberance.

*Coronet.*—The ellipsoidal ridge enclosing the dorsal area in the male puparia of the *Lecaniinæ*.
*Coxa.*—The first joint of the leg.
*Dermis.*—The cuticle or skin.
*Digitules.*—Appendages usually present on the feet of the Coccidæ, either broadly dilated or in the form of knobbed hairs.
*Dimerous.*—Composed of two pieces.
*Dorsal.*—Relating to the upper parts of the body.
*Dorsum.*—The back or upper parts of the body.
*Ecdysis.*—The act of casting off an integument.
*Exuviæ.*—Discarded skins.
*Fecundation.*—The act of impregnation.
*Femur.*—The thigh or third joint of the leg.
*Filiform.*—Thread-like.
*Fimbriate, fimbriated.*—Fringed.
*Genæ.*—The cheeks.
*Genital armature, genitalia.*—The reproductive organs of the male.
*Gestation.*—The period during which the female is maturing the ova or embryos.
*Gibbose.*—Having a hump or rounded elevation.
*Habitat.*—The natural abode or locality.
*Halteres.*—A pair of small organs which replace the hind wings of the male.
*Lamellæ.*—Thin plates or scales.
*Larva.*—The first active stage of the insect.
*Mentum.*—The lower part of the mouth.
*Mesothorax.*—The median division of the thorax.
*Metathorax.*—The hinder division of the thorax.
*Mm.* (*millimetre*).—The 1000th part of a metre, or approximately one twenty-fifth of an inch.
*Monomerous.*—Of a single piece or joint.
*Monotypic.*—Having one representative only, as a genus with a single species.
*Nervures.*—The so-called veins of the wing.
*Ocelli.*—The simple or supplementary eyes.
*Oviparous.*—Producing eggs.
*Oviposition.*—The act of laying eggs.

*Ovisac.*—The envelope in which the eggs are laid; sometimes mentioned as *sac.*

*Ovoviviparous.*—Producing eggs which are hatched within the body of the parent or during the process of extrusion.

*Ovum.*—The egg.

*Parasitised.*—Containing parasites. Affected or attacked by parasites.

*Parastigmatic glands.*—Circular glands sometimes present around the openings of the spiracles.

*Parthenogenesis, parthenogenetic.*—Reproduction without the intervention of the male.

*Parturition.*—The period during which the female is producing ova or larvæ.

*Polygonal.*—Having many angles.

*Prothoraæ.*—The anterior division of the thorax, bearing the first pair of legs.

*Pulverulent.*—Having finely-powdered secretion.

*Pupa.*—The "chrysalis" or resting stage of the male.

*Puparium.*—The secretionary covering of the male and female *Diaspinæ*, and the males of other subfamilies of the Coccidæ.

*Pygidium.*—The compound terminal segment of the *Diaspinæ* and *Conchaspinæ.*

*Rostral filaments.*—The four hair-like processes which together form the sucking-tube.

*Rostrum.*—The upper part of the mouth from which spring the rostral filaments.

*Rudimentary.*—Undeveloped.

*Rugose.*—With fine wrinkled lines.

*Scale.*—The secretionary covering of various coccids. Used also as a general term for scale-insects.

*Scutellum.*—A conspicuous shield-shaped scute on the dorsal surface of the metathorax.

*Secretion.*—Matter produced by the various glands of the body.

*Secretionary covering.*—That part of a Diaspid puparium covering the exuviæ.

*Segments.*—The divisions of the body.

*Septum.*—A partition separating two cavities.
*Setiferous.*—Bearing hairs.
*Spinnerets.*—Organs concerned in the emission of matter of which the puparia and ovisacs of various Coccidæ are composed.
*Spinose.*—Bearing spines.
*Spiracles.*—The respiratory orifices.
*Stylus.*—The outer sheath of the genital armature of the male.
*Tarsus.*—The terminal joint of the leg.
*Tesselated.*—Formed of irregular-sided cells.
*Test.*—The secretionary covering which is *attached* to the bodies of female coccids (*e. g. Ceroplastes*).
*Thoracic.*—Belonging to the thorax.
*Thorax.*—The second of the main divisions of the body.
*Tibia.*—The fourth joint of the leg.
*Tracheæ.*—The spiral vessels of the respiratory system.
*Triarticular.*—With three joints.
*Trochanter.*—The second joint of the leg, in the Coccidæ usually fused to the femur.
*Ventral.*—Relating to the under surface of the body.

### Signs used.

♀ = Female. ♂ = Male.

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# PLATE F.

## EXPLANATION OF PLATE F.

KERMES QUERCUS. (Page 142.)

Figs. 1, 1 *a*, 1 *b*.—*Very slightly* enlarged photograph of old adult females *in situ* on oak bark. The females opposite figs. 1, 1 *a* are quite naked; those opposite fig. 1 *b*, and five others in the central crevice, are partly or wholly covered in cereous matter.

Fig. 2.—Two male puparia; the lower one shows the exit hole of a chalcidid parasite (same magnification as Fig. 1).

1 *a* ☞

☞ 2

☞ 1

1 *b* ☞

KERMES QUERCUS, *Linn.*

*R. Newstead, Photo.*

*Adlard & Son, Imp.*

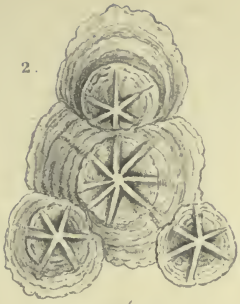
# PLATE XXXV.

## EXPLANATION OF PLATE XXXV.

CONCHASPIS ANGRÆCI. (Page 3.)

Fig. 1.—Insects natural size *in situ* on portion of a leaf of the food-plant.
Fig. 2.—Group of four puparia of adult female in various stages (dorsal). × 25.
Fig. 3.—Puparium of adult female (profile). × 40.
Fig. 4.—Adult female after treatment with potash (ventral). × 40.
Fig. 5.—Pygidium of adult female. × 250.
Fig. 6.—Terminal portion of pygidium of adult female. × 600.
Fig. 7.—Antenna of adult female. × *circa* 250.
Fig. 8.—Leg of the adult female. × *circa* 250.
Fig. 9.—Tibio-tarsal joint of larva. × *circa* 250.
Fig. 10.—Antenna of larva. × *circa* 250.

1.


2.

3.

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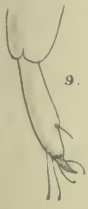
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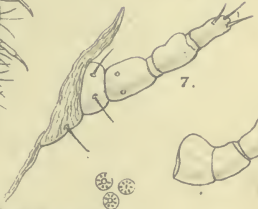
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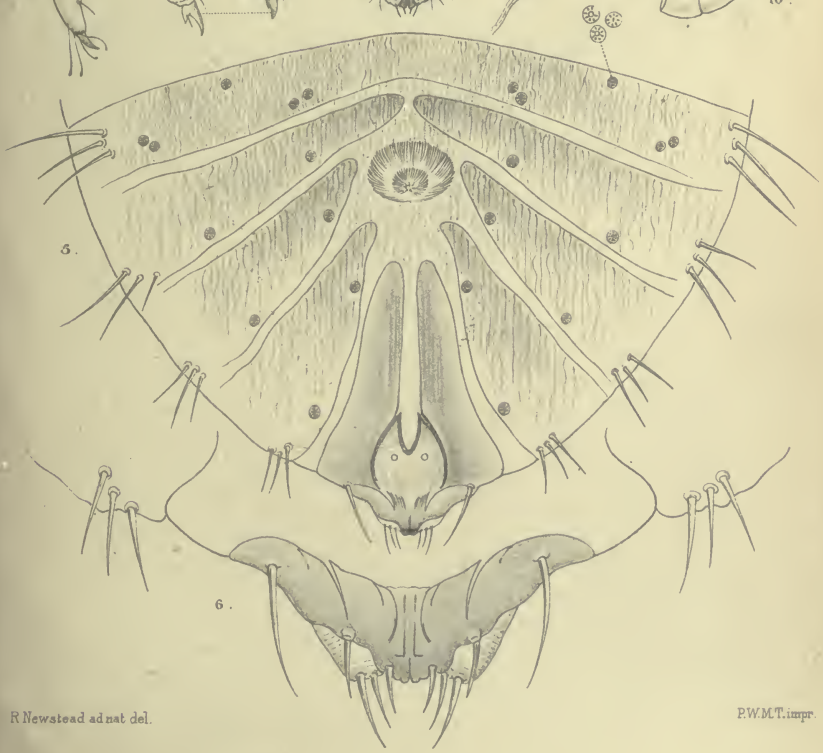
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# PLATE XXXVI.

## EXPLANATION OF PLATE XXXVI.

### Antonina socialis. (Page 207.)

Figs. 1 *a*, *b*.—Insects natural size beneath the leaf-sheaths of *Arundinaria japonica*, in company with *Aclerda japonica*.

Fig. 2.—Adult female (ventral) after treatment with potash. × 10.

Fig. 3.—Antennæ of adult female. × 250.

Fig. 4.—One of the four spiracles of the adult female: *d*, dermis; *s*, spinnerets; *t*, inner tubular supports; *o*, orifice. × 600.

### Aclerda japonica. (Page 11.)

Fig. 1.—Insects natural size *in situ*, partly hidden beneath the leaf-sheaths (*a*, *b*) of the food-plant (*Arundinaria japonica*) in company with *Antonina socialis*.

Fig. 5.—Adult female after treatment with potash. × 10.

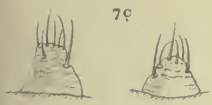
Fig. 6.—Spiracle of adult female: *d d*, dermis; *s*, spinnerets in crescent-shaped flange; *v*, valve closing opening; *t*, inner tubular supports; *t a*, point of tracheal attachments. × 600.

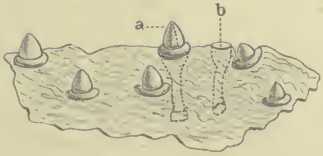
Fig. 6 *a*.—Spiracle of immature female with tracheal tubes attached. × 600.

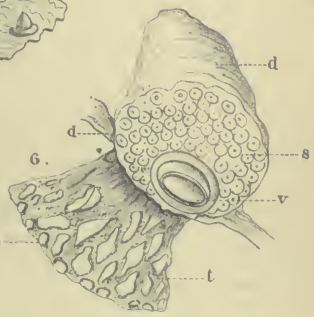
Fig. 7.—Portion of dermis of adult female from anterior extremity with acorn-shaped spines: *a*, hollow secreting spine of similar character, with long subcutaneous inner tube; *b*, the same with spine broken away. × 600.

Fig. 7 *c*.—Rudimentary antennæ of adult female. × 250.

Fig. 8.—Anal ring of adult female, with the anal lobes (*a*) forced apart (magnified).



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# PLATE XXXVII.

## EXPLANATION OF PLATE XXXVII.

ANTONINA SOCIALIS. (Page 207.)

Fig. 1.—Anal orifice with six long hairs lying within the "trough-shaped cavity at the posterior extremity of the body." × 600.

ACLERDA JAPONICA. (Page 11.)

Fig. 2.—Anal extremity of adult female, showing anal cleft with hairs of anal ring slightly projecting (dorsal). × 250.

Fig. 3.—Anal ring with surrounding parts (ventral). × 600.

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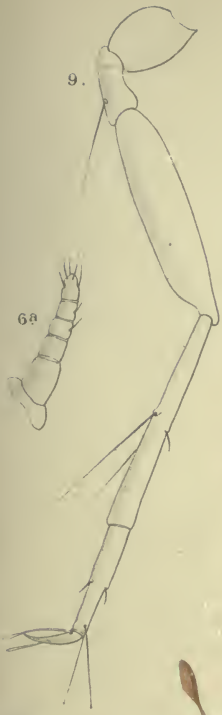
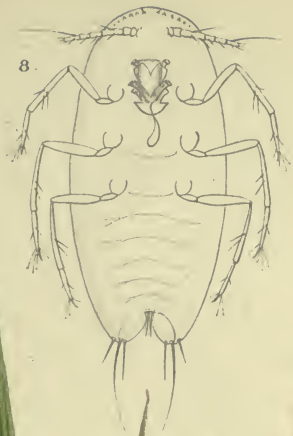
# PLATE XXXVIII.

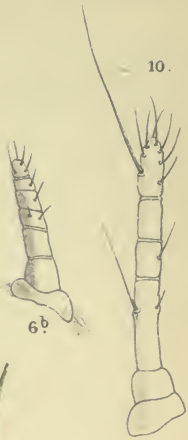
## EXPLANATION OF PLATE XXXVIII.

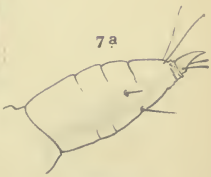
ERIOPELTIS FESTUCÆ. (Page 21.)

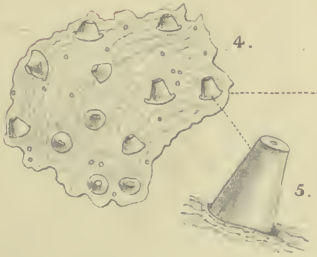
Figs. 1–1 *b*.—Insects natural size *in situ* on grass (*Festuca* sp.); 1 *a* represents a newly-formed ovisac, 1 *b* the older and more closely-felted ovisacs.
Fig. 2.—Adult female after treatment with potash (dorsal). × 12.
Fig. 3.—Adult female after treatment with potash (ventral). × 12.
Fig. 4.—Dermis of adult female with truncate spines (dorsal). × 140.
Fig. 5.—Truncate spine. × 600.
Figs. 6, 6 *a*, 6 *b*.—Antennæ of adult female. × 140.
Fig. 7.—Leg of the adult female. × 140.
Fig. 7 *a*.—Tarsus and claw of adult female. × 300.
Fig. 8.—Larva after treatment with potash (ventral). × 70.
Fig. 9.—Leg of the larva. × 300.
Fig. 10.—Antenna of the larva. × 300.

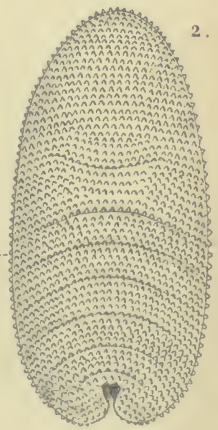




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# PLATE XXXIX.

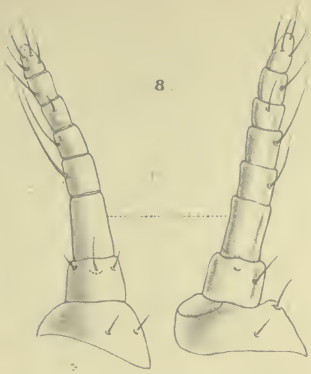
## EXPLANATION OF PLATE XXXIX.

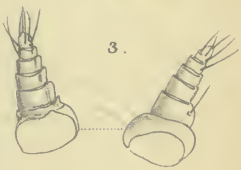
### Lecanopsis brevicornis. (Page 15.)

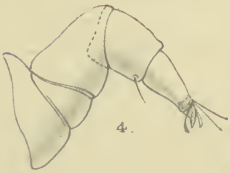
Fig. 1.—Adult female removed from the glassy ovisac (dorsal). × 15.
Fig. 1 *a*.—The same (ventral). × 15.
Fig. 2.—Adult female after treatment with potash (ventral). × 20.
Fig. 3.—Antennæ of adult female. × 140.
Fig. 4.—Anterior leg of adult female. × 140.
Fig. 4 *a*.—Posterior leg of adult female. × 140.
Fig. 5.—Spiracle of adult female. × 140.

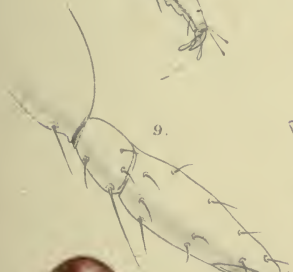
### Lecanopsis formicarum. (Page 17.)

Fig. 6.—Adult female from life (dorsal). × 8.
Fig. 7.—Adult female after treatment with potash (ventral). × 10.
Fig. 8.—Antennæ of adult female. × 140.
Fig. 9.—Leg of the adult female. × 70.
Fig. 9*a*.—Tibio-tarsal joint of adult female. × 140.
Fig. 10.—Spiracle of adult female. × 140.







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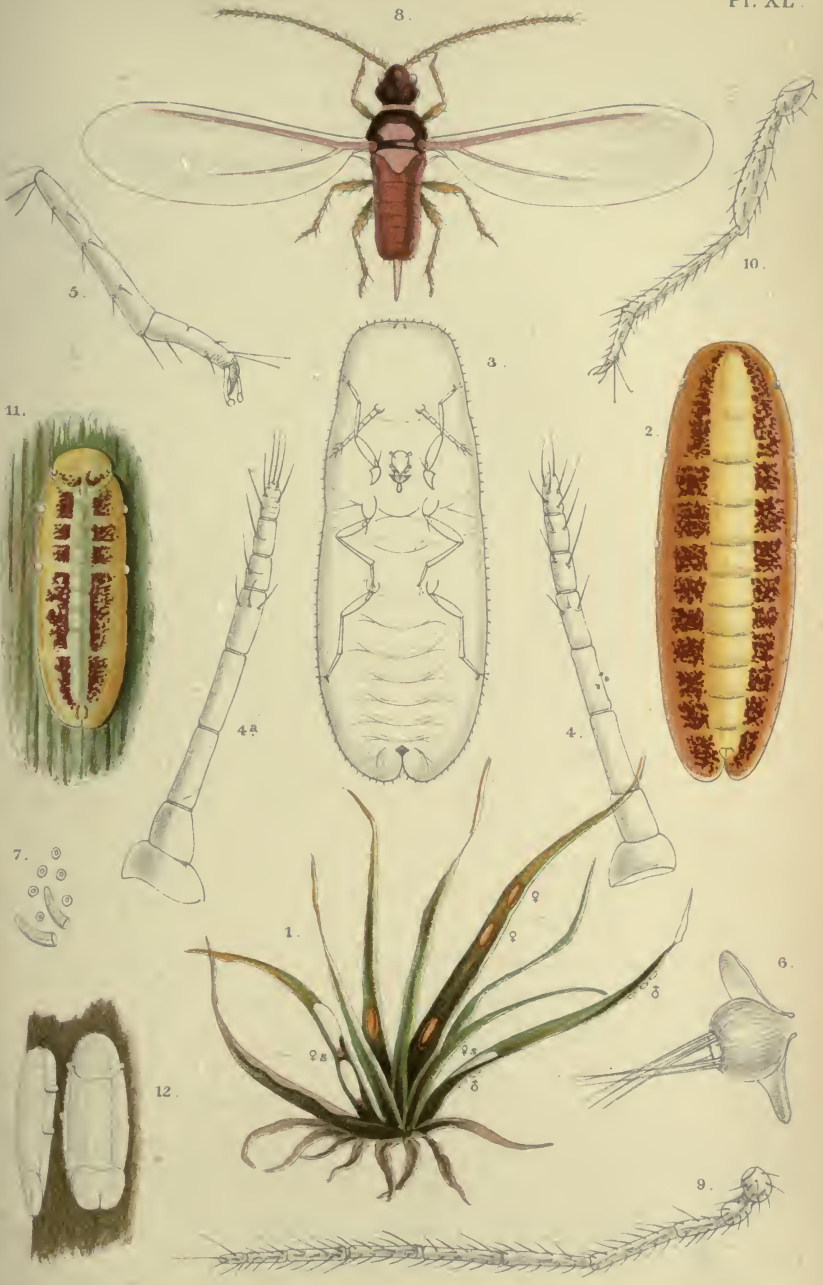
# PLATE XL.

## EXPLANATION OF PLATE XL.

SIGNORETIA LUZULÆ. (Page 27.)

Fig. 1.—Insects natural size *in situ* on a plant of *Luzula campestris:* ♀ indicates females immediately prior to the formation of the ovisac; ♀ s = female sacs; and ♂ = male puparia on under side of leaf.
Fig. 2.—Second stage female. × 15.
Fig. 3.—Adult female after treatment with potash. × 15.
Figs. 4, 4 *a*.—Antennæ of adult female. × 140.
Fig. 5.—Tibia and tarsus of adult female. × 140.
Fig. 6.—Anal ring of adult female with the basal retractile sac fully extended and the anal lobes diverted. × 140.
Fig. 7.—Stigmatic spines and spinnerets. × 300.
Fig. 8.—Male. × 30.
Fig. 9.—Antenna of the male. × 70.
Fig. 10.—Leg of the male. × 70.
Fig. 11.—Second-stage male. × 35.
Fig. 12.—Puparia of the male. × 20.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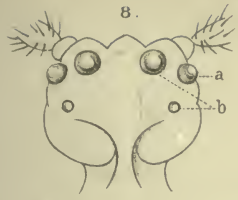
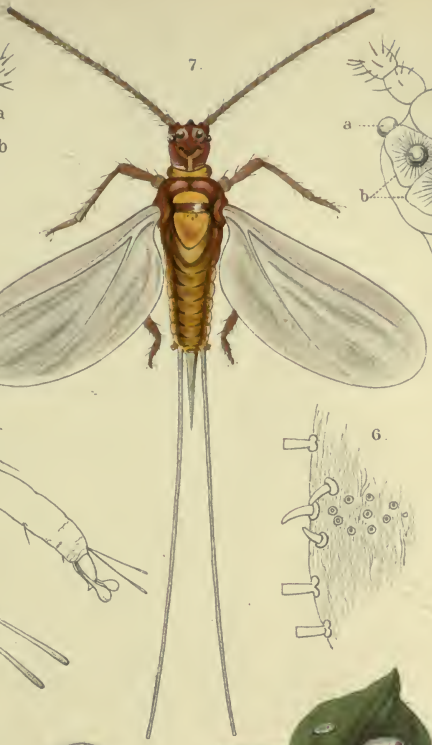
# PLATE XLI.

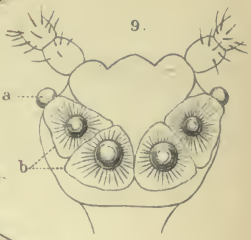
## EXPLANATION OF PLATE XLI.

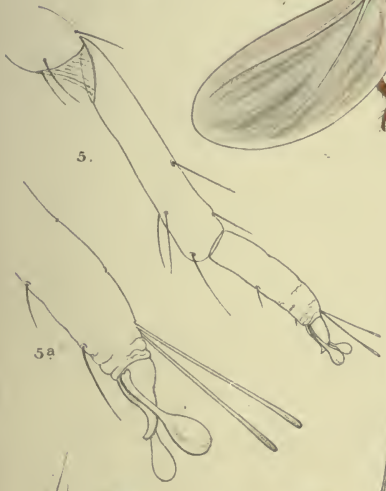
LICHTENSIA VIBURNI. (Page 33.)

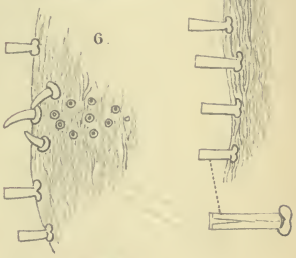
Fig. 1.—Insects (male puparia and female ovisacs) natural size *in situ* on ivy leaf.
Fig. 2.—Adult females natural size immediately prior to the formation of the ovisac, on branch of ivy.
Fig. 3.—The same. × 7.
Figs. 4, 4 *a*.—Antennæ of adult female. × 140.
Fig. 5.—Leg of the adult female. × 140.
Fig. 5 *a*.—Tarsus and claw of adult female. × 300.
Fig. 6.—Stigmatic area of adult female with spines and grouped spinnerets. × 300.
Fig. 6 *a*.—Marginal spines of adult female. × 300.
Fig. 7.—Male. × 25.
Fig. 8.—Head of male (dorsal): *a*, eye; *b*, ocelli. × 100.
Fig. 9.—The same (ventral): *a*, eye; *b*, ocelli. × 100.
Fig. 10.—Pupa, dorsal. × 25.
Fig. 11.—Male puparium. × 25.

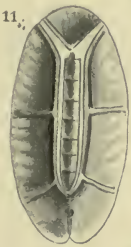


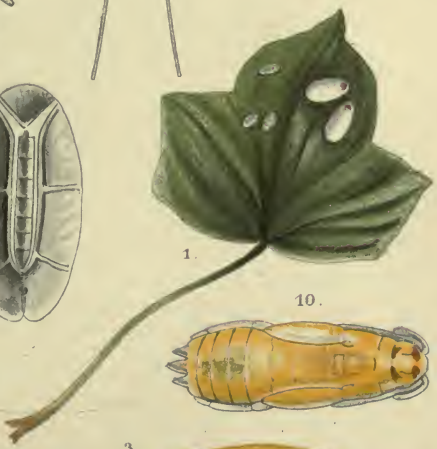



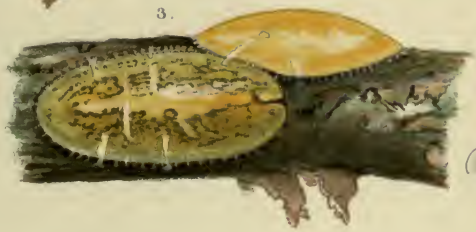











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# PLATE XLII.

## EXPLANATION OF PLATE XLII.

CEROPLASTES CISTUDIFORMIS. (Page 40.)

Fig. 1.—Female insects natural size *in situ* on a portion of an orchid (*Chrysis bractescens*). *a*, old adults; *b*, young adults.
Fig. 1 *c*.—Old adult female. × 2.
Fig. 2.—Leg of old adult female. × 140.
Fig. 2 *a*.—Tarsus and claw of same. × 300.
Fig. 3.—Antenna of old adult female. × 140.
Fig. 4.—Dorsal dermis of old adult female. × 140.
Fig. 5.—Spiracle of old adult female. × 140.
Fig. 6.—Young adult female after treatment with potash (ventral). × 10.
Fig. 7.—Antenna of young adult female. × 140.
Fig. 8.—Tibia and tarsus of young adult female. × 140.
Fig. 9.—Stigmatic spines of young adult female. × 300.
Fig. 9 *a*.—Marginal hairs of young adult female. × 50.
Fig. 10.—Dermis of young adult female. × 600.
Fig. 11.—Young adult females, showing two stages (*a* and *b*) of the tests or pellicles. × 7.
Fig. 12.—Fully developed larva or first-stage female. × 10.

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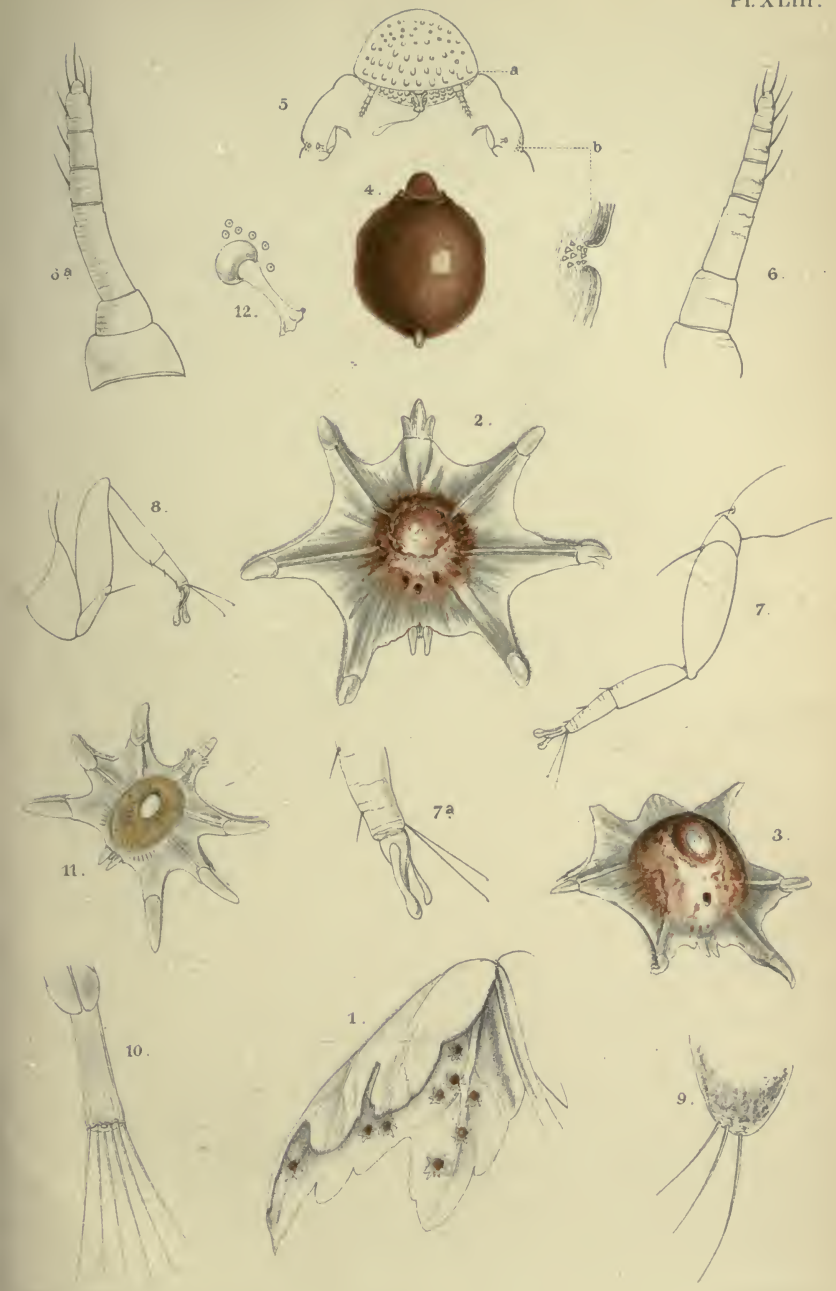
# PLATE XLIII.

## EXPLANATION OF PLATE XLIII.

VINSONIA STELLIFERA. (Page 44.)

Fig. 1.—Female insects natural size *in situ* on leaf of chrysanthemum.
Fig. 2.—Old adult female, with star-shaped test or cereous covering (dorsal). × 25.
Fig. 3.—Another example with the three anterior arms imperfect (semi-profile). × 25.
Fig. 4.—Adult female denuded of cereous test (dorsal). × 30.
Fig. 5.—Cephalic extremity of adult female, showing (*a*) the distinct articulation; (*b*) the stigmatic area, antennæ, rostrum, and anterior pair of legs (ventral). × 90.
Figs. 6, 6*a*.—Antennæ of old adult female. × 300.
Fig. 7.—Posterior leg of old adult female. × 300.
Fig. 7*a*.—Tarsus and claw of adult female. × 600.
Fig. 8.—Anterior leg of old adult female. × 300.
Fig. 9.—Anal lobe of old adult female. × 300.
Fig. 10.—Anal ring of old adult female (extended). × 140.
Fig. 11.—Female larva: third stage of cereous test. × 25.
Fig. 12.—Spiracle of adult female. × 300.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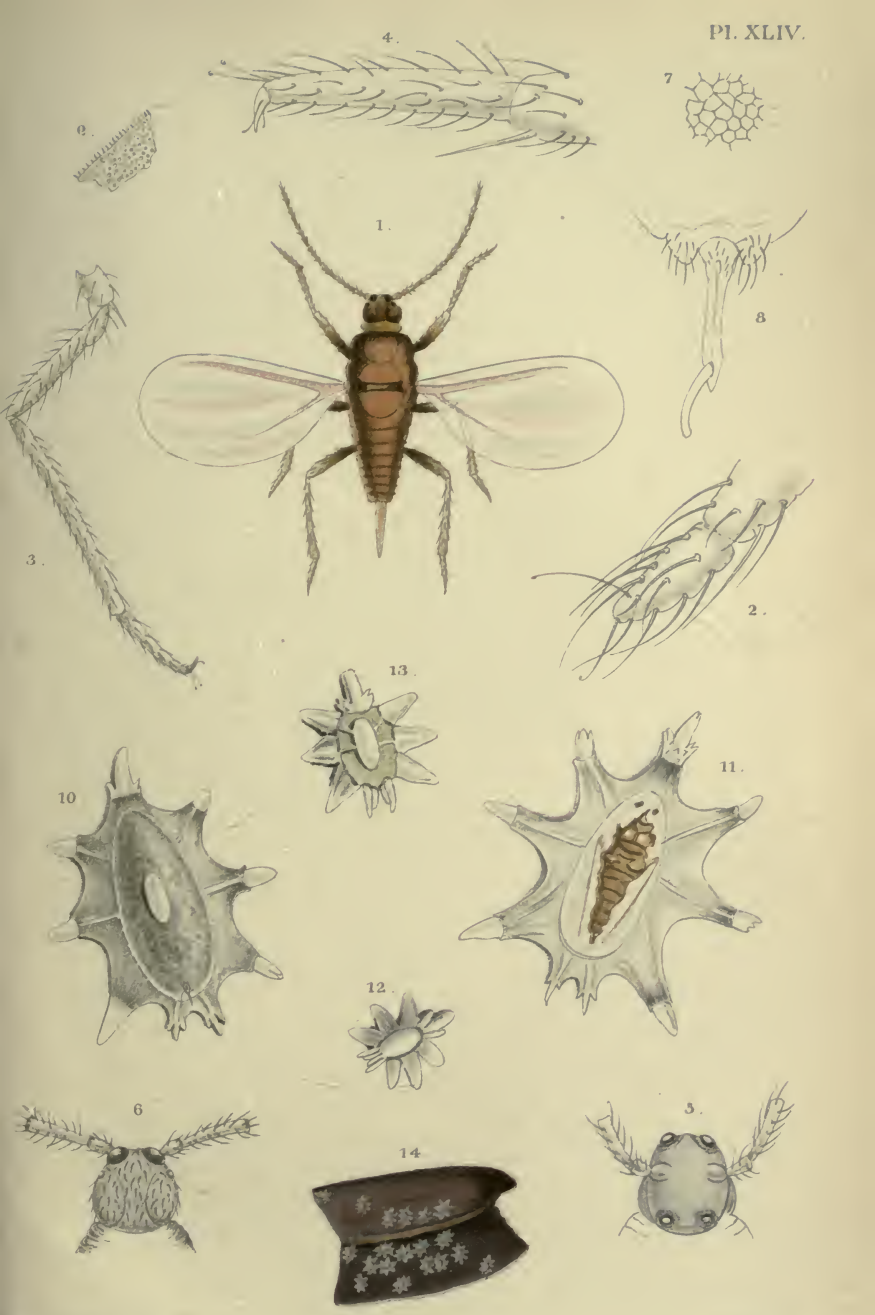
# PLATE XLIV.

## EXPLANATION OF PLATE XLIV.

VINSONIA STELLIFERA. (Page 44.)

Fig. 1.—Male (extracted from puparium). × 35.
Fig. 2.—Terminal joint of male antenna. × 300.
Fig. 3.—Leg of the male. × 70.
Fig. 4.—Tarsus and claw of the male. × 300.
Fig. 5.—Under side of the head of the male. × 100.
Fig. 6.—Upper side of ditto. × 100.
Fig. 7.—Portion of the dermis of the genæ of the male, showing reticulation. × 600.
Fig. 8.—Terminal segment of male, with genital armature, and penis protruding at extremity. × 70.
Fig. 9.—Portion of hind margin of wing of male. × 600. (Figure reversed.)
Fig. 10.—Empty puparium of male (dorsal). × 25.
Fig. 11.—Puparium of male with portions broken away, revealing the imago within (ventral). × 25.
Fig. 12.—Female larva (first stage of test). × 25.
Fig. 13.—The same in a more advanced stage. × 25.
Fig. 14.—Male puparia, natural size, *in situ* on leaf of *Cypripedium*.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# PLATE XLV.

## EXPLANATION OF PLATE XLV.

PULVINARIA VITIS. (Page 51.)

Fig. 1.—Female insects natural size *in situ* on a branch of the vine.

Fig. 1*a*.—Female insect in profile, showing the tilted position of the insect after parturition; the dotted line indicates the extent of the ovisac. × 1·50.

Figs. 2, 2*a*.—Pair of typical antennæ from adult female (a very large example). × 140.

Fig. 3.—Antenna of adult female (smaller example). × 140.

Fig. 4.—Example of seven-jointed antennæ of adult female. × 140.

Fig. 5.—Abdominal extremity of adult female, showing derm-glands, anal lobes, and anal ring. × 70.

Fig. 5 *a*.—Anal lobe of adult female. × 250.

Fig. 5*b*.—Anal ring of adult female. × 250.

Fig. 6.—Antenna of young adult female. × 140.

Fig. 7.—Leg of young adult female. × 140.

Fig. 8.—Anal ring of young adult female. × 250.

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# PLATE XLVI.

## EXPLANATION OF PLATE XLVI.

PULVINARIA VITIS, var. RIBESIÆ. (Page 55.)

Fig. 1.—Females natural size *in situ* on branch of *Ribes sanguineum*, as seen in March after hibernation.

Fig. 2.—Females natural size, *in situ* on *R. sanguineum*, as seen early in May. Two examples have commenced the formation of the ovisac.

Fig. 3.—Female insects natural size after the completion of the ovisac.

Fig. 4.—Adult female after treatment with potash (ventral). × 15.

Fig. 5.—Portion of dermis showing large cells and reticulation (dorsal). × 250.

Fig. 6.—Portion of ventral dermis showing minute tubular spinnerets. × 600.

Fig. 7.—Pair of normal eight-jointed antennæ from an adult female. × 140.

Fig. 8.—Abnormal seven-jointed antenna of adult female. × 140.

Fig. 9.—Abnormal six-jointed antenna of adult female. × 140.

Fig. 10.—Leg of the adult female. × 140.

Fig. 11.—Mentum of adult female shown without the filaments and basal attachments. × 140.

Fig. 12.—Stigmatic and marginal spines. × 300.

Fig. 13.—Female at period of fecundation (ventral). × 12.

Fig. 14.—The same showing characteristic reticulation (dorsal). × 12.

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# PLATE XLVII.

## EXPLANATION OF PLATE XLVII.

PULVINARIA VITIS, var. RIBESIÆ. (Page 55.)

Fig. 1.—Puparia of the male with caudal filaments of the perfect insect projecting at the posterior extremity. The two coloured examples represent the male before formation of puparium, slightly enlarged.
Fig. 2.—Second stage of the male larva. × 12.
Fig. 2 *a*.—Antenna of second-stage male. × 140.
Fig. 2 *b*.—Leg of the second-stage male. × 140.
Fig. 3.—A more advanced stage of the male larva, showing the puparium almost completed. × 12.
Fig. 4.—Puparium of the male after the escape of the insect. × 20.
Fig. 5.—Pupa, first stage. × 20.
Fig. 6.—Pupa, final stage. × 20.
Fig. 6 *a*.—Anal segment of true pupa showing lobes and rudimentary genital armature. × 100.
Fig. 6 *b*.—Antennal sheath of pupa revealing the antenna of the perfect male within. × 100.
Fig. 6 *c*.—Leg-sheath of the same revealing the leg of the perfect male within. × 100.
Fig. 7.—Male. × 100.
Fig. 7 *a*.—Underside of the head of the male. × 100.
Fig. 7 *b*.—Antenna of the male. × 100.
Fig. 7 *c*.—Apical joint of the same. × 250.
Fig. 7 *d*.—Anal segment of the male with genital armature, etc. × 100.

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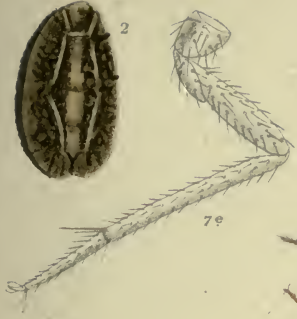
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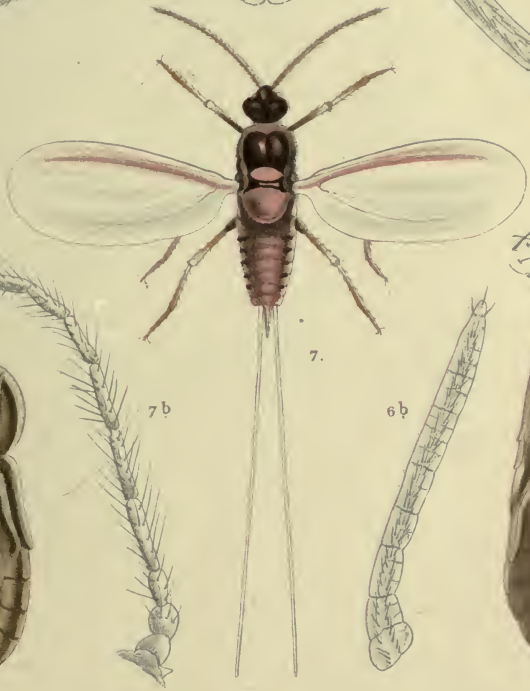
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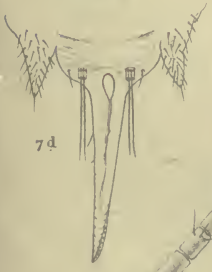
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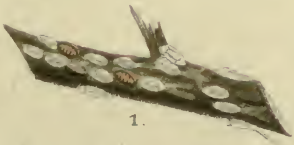
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6a

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# PLATE XLVIII.

## EXPLANATION OF PLATE XLVIII.

PULVINARIA FLOCCIFERA. (Page 71.)

Figs. 1, 1 *a*.—Insects natural size *in situ* on camellia leaf and branch.

Fig. 2.—Adult female and ovisac, the latter with longitudinal and transverse cracks or fissures revealing the pink colour of the eggs within. × 4.

Fig. 3.—Adult female after treatment with potash (ventral). × 20.

Fig. 4.—Dermis of adult female, showing character of derm-cells (dorsal). × 140.

Fig. 5.—Dermis of adult female with tubular spinnerets (ventral). × 600.

Fig. 6.—Normal antenna of adult female. × 140.

Fig. 6 *a*.—Abnormal antenna of adult female. × 140.

Fig. 7.—Leg of the adult female. × 140.

Fig. 8.—Marginal hairs and stigmatic spines of adult female. × 300.

Fig. 9.—One of the three pairs of dorsal hairs from abdomen of adult female. × 300.

Fig. 10.—Second-stage female. × 10.

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# PLATE XLIX.

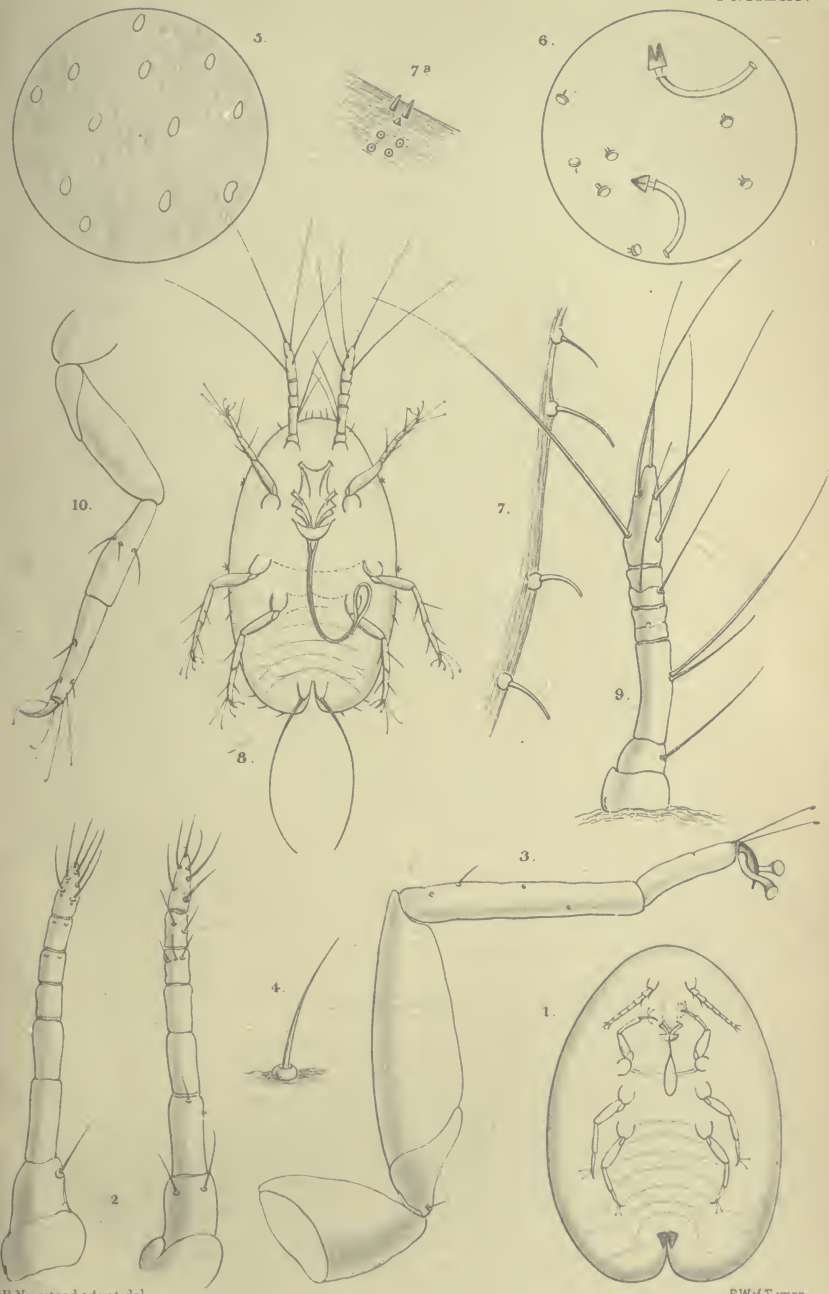
## EXPLANATION OF PLATE XLIX.

### Pulvinaria mesembryanthemi. (Page 69.)

Fig. 1.—Adult female after treatment with potash (ventral). × 15.
Fig. 2.—Antennæ of adult female. × 140.
Fig. 3.—Leg of the adult female. × 140.
Fig. 4.—Dorsal spine of adult female. × 140.
Fig. 5.—Dermis of adult female (dorsal). × 600.
Fig. 6.—Dermis of adult female (ventral). × 600.
Fig. 7.—Marginal spines of adult female. × 300.
Fig. 7 *a*.—Stigmatic spines of adult female. × 300.

### Pulvinaria vitis. (Page 51.)

Fig. 8.—Larva after treatment with potash (ventral). × 80.
Fig. 9.—Antenna of the larva. × 300.
Fig. 10.—Leg of the larva. × 300.

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# PLATE L.

## EXPLANATION OF PLATE L.

### Lecanium hesperidum. (Page 78.)

Fig. 1.—Insects natural size *in situ*.
Fig. 2.—Female at period of gestation; example from underside of bay leaf. × 10.
Fig. 2*a*.—Younger form from orange showing similar markings. × 10.
Fig. 3.—Female at period of gestation; immaculate form from *underside* of bay leaf. × 10.
Fig. 4.—Female at period of parturition. Early stage, from orange. × 10.
Fig. 5.—A similar example after parturition, from orange. × 10.
Fig. 6.—Antenna of adult female. × 140.
Fig. 7.—Leg of the adult female. × 140.
Fig. 8.—Portion of dorsal dermis of adult female with derm-cells. × 140.
Fig. 9.—Marginal spines of adult female. × 300.
Fig. 10.—Adult female of the form named *alienum* by Douglas. × 10.

### Lecanium longulum. (Page 86.)

Fig. 11.—Young adult female at period of gestation. × 10.
Fig. 12.—Antenna of adult female. × 140.
Fig. 13.—Portion of dorsal dermis with derm-cells. × 140.
Fig. 14.—Leg of the adult female. × 140.

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# PLATE LI.

## EXPLANATION OF PLATE LI.

LECANIUM PERSICÆ. (Page 89.)

Fig. 1.—Insects natural size *in situ* on peach branch; 1 *b*, at period of gestation; 1 *a*, after parturition.
Figs. 2, 2 *a*.—Antennæ of adult female. × 140.
Fig. 2 *b*.—Antennæ of diseased female. × 140.
Fig. 3.—Leg of adult female. × 140.
Fig. 4.—Dermis from the dorsal region showing faint tesselation and both forms of derm-cells. × 140.
Fig. 4 *a*.—The same showing group of large derm-cells above anal lobes. × 140.
Fig. 5.—Dermis at margin with marginal spines. × 140.
Fig. 6.—Spiracle with spinnerets. × 300.
Fig. 7.—Tubular spinnerets of adult female from ventral dermis near the margins. × 600.
Fig. 8.—Spine from ditto. × 600.

LECANIUM PERSICÆ, var. CORYLI. (Pages 94, 253.)

Fig. 9.—Insects natural size *in situ* on currant branch: 9 *a*, females at period of gestation; 9 *b*, females after parturition; 9 *c*, scar or mark of secretion left upon the branch after the removal of the insect.
Fig. 10.—Larva shortly before hibernating, with long, iridescent, glassy filaments. × 20.

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# PLATE LII.

## EXPLANATION OF PLATE LII.

LECANIUM CILIATUM. (Page 96.)

Fig. 1.—Insects natural size *in situ* on portion of oak branch; ♀ = adult female; ♂ = male puparium, with caudal filaments projecting at anal extremity.
Fig. 2.—Female at period of fecundation. × 15.
Fig. 3.—Antennæ of adult female (normal). × 140.
Fig. 3 *a*.—Antennæ of adult female (abnormal). × 140.
Fig. 4.—Leg of the adult female (anterior). × 140.
Fig. 4 *a*.—Leg of the adult female (intermediate). × 140.
Fig. 5.—Marginal secreting spines of adult female. × 300.
Fig. 6.—Spiracle and glands of adult female. × 140.
Fig. 7.—Portion of dermis showing polygonal cells. × 300.
Fig. 8.—Immature female in process of moulting, with exuviæ of previous stage (fig. 9) superimposed. × 25.
Fig. 9.—Second-stage female after hibernation. × 25.
Fig. 10.—Male. × 25.
Fig. 11.—Puparium of male. × 15.

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# PLATE LIII.

## EXPLANATION OF PLATE LIII.

LECANIUM BITUBERCULATUM. (Page 101.)

Fig. 1.—Insects natural size *in situ* on branch of hawthorn.
Figs. 1 *a a*, 1 *b*.—Parasitised females natural size.
Fig. 2.—Adult female after parturition. × 6.
Fig. 3.—Female at period of fecundation. × 15, and natural size.
Fig. 4.—Antenna of the adult female. × 140.
Fig. 4 *a*.—Another form of the same. × 140.
Fig. 5.—Leg of the adult female. × 140.
Fig. 5 *a*.—Tarsus and claw of the adult female. × 300.
Fig. 6.—Anal lobes of the adult female (dorsal). × 140.
Fig. 6 *a*.—The same (ventral). × 140.
Fig. 7.—Spiracle of the adult female. × 300.
Fig. 7 *a*.—Semi-ventral view of same. × 300.
Figs. 8, 8 *a*.—Marginal spines of the adult female. × 300.
Fig. 9.—Male. × 25.

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# PLATE LIV.

## EXPLANATION OF PLATE LIV.

LECANIUM CAPREÆ. (Page 105.)

Fig. 1.—Adult females at period of parturition, natural size *in situ* on branch of hawthorn (from life).

Fig. 2.—Adult female at period of fecundation. × 6.

Fig. 2 *a*.—Another variety of the same. × 6.

Fig. 2 *b*.—Another variety of the same. × 6.

Figs. 3, 3 *a*.—Old adult females after death, natural size (posterior view).

Fig. 3 *b*.—Old adult female after death attached to base of spine (ventral view), natural size.

Fig. 3 *c*.—Old adult female after death, natural size (semi-profile view).

Fig. 4.—Parasitised form with double mammiform swellings (posterior view), very slightly enlarged.

Fig. 4 *a*.—Another parasitised form with the mammiform swellings much more elevated and placed closely together (profile), very slightly enlarged.

Figs. 4 *b*, 4 *c*.—Two parasitised forms without mammiform swellings, showing perforations through which the parasites have escaped. Natural size.

Figs. 5, 5 *a*, and 5 *b*.—Antennæ of the adult female. × 140.

Fig. 6.—Leg of the adult female. × 140.

Fig. 7.—Marginal spines of the adult female. × 140.

Fig. 8.—Second-stage female with part of previous moult attached to its back. × 10.

Fig. 9.—Larvæ (full-fed) prior to first moult. × 15.

Fig. 10.—Male. × 25.

Fig. 11.—Puparium of male. × 10.

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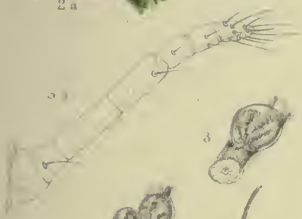


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3 a.


3 b.


3 c.

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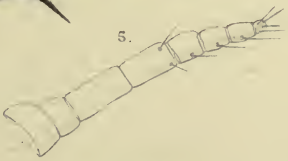
4 a.


4 c.

4 b.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F.W.M. Prop. impr.

# PLATE LV.

## EXPLANATION OF PLATE LV.

LECANIUM PERFORATUM. (Page 121.)

Fig. 1.—Insects natural size *in situ* on underside of leaf of *Wallichia densiflora*.

Fig. 2.—Young adult female. × 10.

Fig. 3.—Adult female showing tesselation as seen by transmitted light. × 10.

Fig. 4.—Marginal plates with eye in clear fusiform space at *a*. × 40.

Fig. 5.—One of the posterior submarginal plates with large subcentral gland-like perforation, and smaller perforations at margins. × 40.

Figs. 6, 6 *a*.—Antennæ of adult female. × 140.

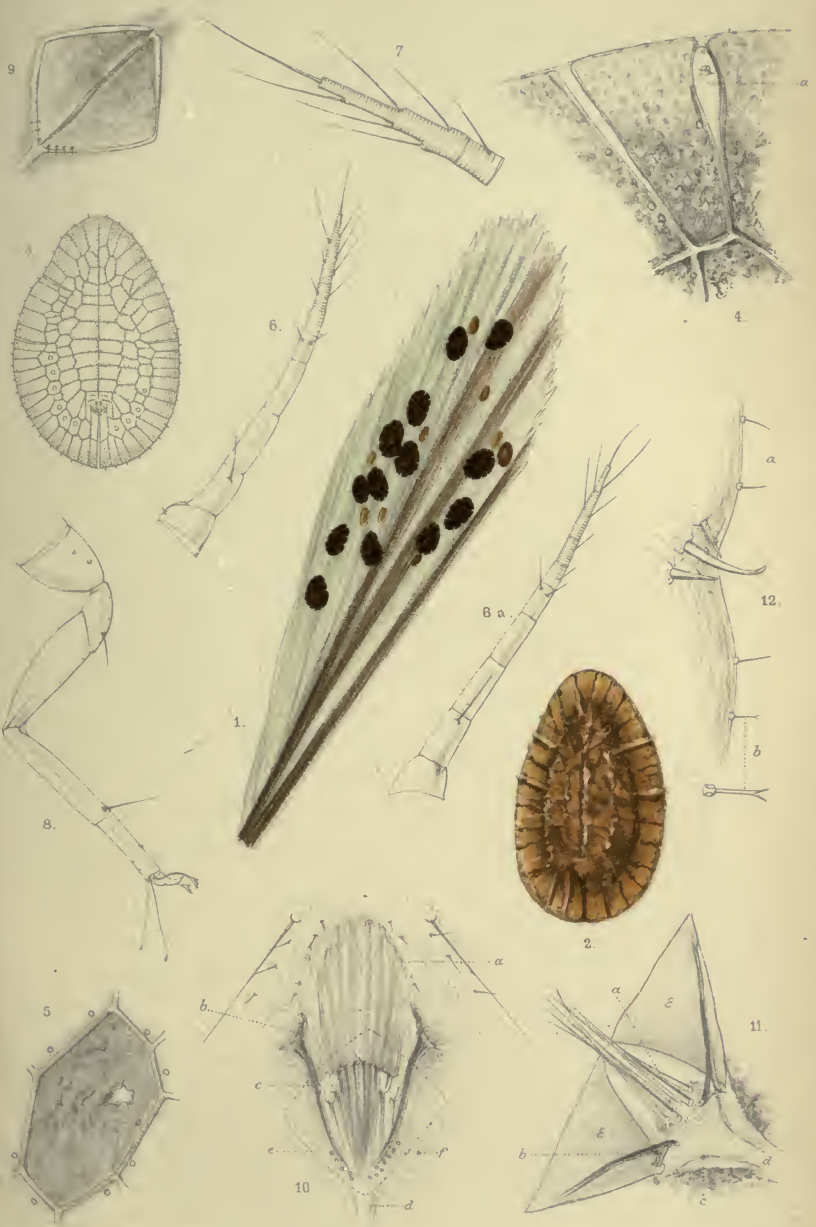
Fig. 7.—Terminal joint of same. × 300.

Fig. 8.—Leg of the adult female. × 140.

Fig. 9.—Anal lobes (closed). × 40.

Fig. 10.—Anal ring and surrounding organs (ventral): *a*, base of anal ring; *b*, chitinised lever, probably used for opening and closing anal lobes; *c*, spine bearing tubercles; *d*, upper portion of anal cleft; *e*, dotted line indicating the position of the anal lobes; *f*, ventral spinnerets. × 140.

Fig. 11.—Anal ring and surrounding organs (dorsal) with the anal lobes and ring thrown backwards and upwards by pressure of the covering glass. The letters *a–e* apply to the same parts as those in fig. 10. × 140.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# PLATE LVI.

## EXPLANATION OF PLATE LVI.

LECANIUM HEMISPHÆRICUM. (Page 113.)

Fig. 1.—Adult female after parturition. × 15.
Figs. 1 *a*, 1 *b*.—Normal forms of adult female natural size *in situ* on *Adiantum* and *Pteris*.
Figs. 1 *c*, 1 *d*.—Clypeate forms of adult female natural size *in situ* on stems of *Adiantum*.
Fig. 2.—Antenna of the adult female. × 140.
Fig. 3.—Leg of the adult female. × 140.
Fig. 4.—Marginal spines of the adult female. × 600.
Fig. 5.—Portion of ventral dermis of the adult female, with tubular spinnerets. Magnified.
Fig. 5 *a*.—Tubular spinnerets from ventral dermis. × 600.
Fig. 5 *b*.—Portion of dorsal dermis with derm-cells. × 300.
Fig. 6.—Female at period of gestation showing H-shaped carinæ. × 15.
Fig. 7.—Parasitised female. × 15.
Fig. 8.—Early stage of same. × 20.
Fig. 9.—Female, first stage. × 20.
Fig. 10.—Puparium of male. × 15.
Fig. 11.—Terminal segment of the male (slightly restored), with central portion of the genital sheath or stylus omitted. × 140.
Fig. 12.—Terminal joints of male antennæ. × 300.

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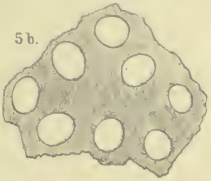
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1 a.

1 b.

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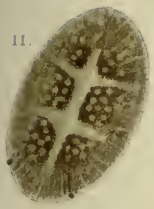
# PLATE LVII.

## EXPLANATION OF PLATE LVII.

LECANIUM OLEÆ. (Page 126.)

Fig. 1.—Insects natural size *in situ* on branch of *Spathelia simplex*.
Fig. 2.—Old adult female, typical form. × 10.
Fig. 3.—Adult female (comparatively flat, brown form). × 10.
Fig. 4.—Antennæ of the adult female. × 140.
Fig. 5.—Leg of the adult female. × 140.
Fig. 5 *a*.—Claw with digitules of same. × 300.
Fig. 6.—Marginal spines of the adult female. × 600.
Figs. 7, 7 *a*.—Polygonal derm-cells. × 300.
Fig. 8.—Portion of ventral dermis with spinnerets. × 600.
Fig. 9.—The same with large spine. × 600.
Fig. 10.—Stigmatic spines of the adult female. × 300.
Fig. 11.—Female at period of gestation. × 10.
Fig. 12.—Female, first stage. × 20.
Fig. 13.—Puparium of male (after Green). × *circa* 25.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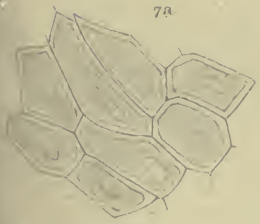

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# PLATE LVIII.

# EXPLANATION OF PLATE LVIII.

## PHYSOKERMES ABIETIS. (Page 132.)

Fig. 1.—Female insects natural size *in situ* on branch of spruce fir.

Fig. 1 *a*.—Terminal bud-scales under which the larvæ locate themselves.

Fig. 2.—Remarkable variety of the female, natural size, discovered in Bohemia by Dr. Karel Šulc (after Šulc).

Fig. 3.—Adult female with left-hand portion of body cut away, revealing the left-hand internal cavity or pouch with the ova. *a a*, line of section shown at fig. 3 *a*; *b*, abdomen with a few remaining ova ready for extrusion; *c*, central body-wall or septum; *d*, posterior portion of same; *e*, cavity or pouch containing extruded ova; *f*, slit in central wall or septum; *g*, approximate position of genital orifice. × 20.

Fig. 3 *a*.—Transverse section of adult female at *a a* in fig. 3; *b*, abdomen with few remaining ova ready for extrusion; *c*, central body-wall or septum (dorsal portion); *d*, ventral portion of same; *e*, cavity or pouch for the reception of the ova; *f*, slit in central wall or septum.

Fig. 4.—Adult female after maceration in potash; *b*, rostrum *c*, cornicles; *d*, cephalic extremity (profile). × 20.

Fig. 5.—Ventral view of adult female after maceration in potash; *a*, opening at ventral extremity of partition wall or septum; *b*, rostrum; *c*, cornicles at posterior extremity; *d*, cephalic extremity. × 20.

Fig. 6.—Dorsal derm-cells of adult female, near cornicles. × 140.

Fig. 6 *a*.—Derm-cells of adult female, with reticulation. × 140.

Fig. 7.—Rostrum of adult female, with filaments. × 140.

Fig. 8.—Anal ring of adult female. × 300.

Fig. 9.—Spiracle of adult female. × 600.

Fig. 10.—Ventral dermis of second-stage female. × 600.

Fig. 11.—Antennæ of second-stage female. × 140.

P.W.M. Trap lith.

# PLATE LIX.

## EXPLANATION OF PLATE LIX.

PHYSOKERMES ABIETIS.' (Page 132.)

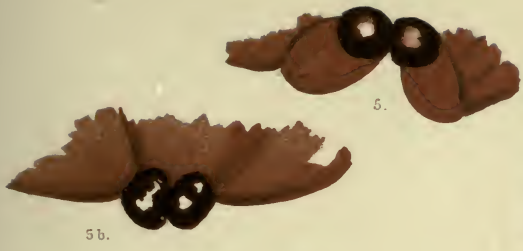
Fig. 1.—Adult females *in situ* surrounding branch (posterior view). × 6.

Fig. 2.—Adult female *in situ* (semi-dorsal view). × 20.

Fig. 3.—Adult female *in situ* (dorsal view). × 20.

Fig. 4.—Adult female removed from branch, with the cephalic extremity exposed (ventral). × 20.

Figs. 5, 5 *a*, 5 *b*.—Cornicles of adult female.



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P.W.M.Trap impr

# PLATE LX.

## EXPLANATION OF PLATE LX.

KERMES VARIEGATUS. (Page 140.)

Fig. 1.—Female insect natural size *in situ* on branch (profile).
Fig. 1 *a*.—The same removed from branch (ventral).
Fig. 2.—Old adult female after parturition (profile). × 4.
Fig. 3.—The same (anterior view). × 4.
Fig. 4.—Antenna of adult female. × 140.
Fig. 5.—Leg of the adult female. × 140.
Figs. 6, 6 *a*.—Portions of ventral dermis of the adult female. × 600.
Fig. 6 *b*.—Tabular spinnerets of the adult female. × 600. (On the plate the figure 6 is reversed.)
Fig. 7.—Anal orifice of the adult female. Enlarged.
Fig. 8.—Larva (ventral). × 100.
Fig. 9.—Antenna of the larva. × 300.
Fig. 10.—Leg of the larva. × 300.
Fig. 11.—Anal extremity of the larva. × 300.

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# PLATE LXI.

## EXPLANATION OF PLATE LXI.

ASTEROLECANIUM BAMBUSÆ. (Page 151.)

Fig. 1.—Insects natural size *in situ* on portion of a leaf of bamboo.

Fig. 2.—Ovisac of adult female with ventral portion removed, revealing the female at period of gestation. × 15.

Fig. 3.—Another example with a portion of the ventral part of the ovisac removed, revealing the female at period of parturition and the cavity behind her filled with the yellow ova. × 15.

Fig. 3*a*.—Ovisac of adult female with the crimson blotches of the sub-lying insect showing through. × 15.

Fig. 4.—Ovisac of old adult female after the death of the insect. × 15.

Fig. 5.—Ovisac of young adult on slender stem of bamboo. × 15.

ASTEROLECANIUM THESII. (Page 154.)

Fig. 6.—Insect (test) *in situ*, *slightly* enlarged.

Fig. 7.—Ovisac of the adult female (profile). × 12.

Fig. 8.—Fringe of the ovisac of the adult female. × 35.

ASTEROLECANIUM VARIOLOSUM. (Page 156.)

Fig. 9.—Insects natural size *in situ* on oak branchlet.

Fig. 10.—Three ovisacs of adult female *in situ*. × 4.

Fig. 11.—Ovisac of adult female at the period when the female entirely fills it (dorsal). × 20.

Fig. 12.—Underside of the same showing the four respiratory channels filled with a white waxy secretion. × 20.

Fig. 13.—Ovisac of adult female after the death of the insect, the desiccated body of which is indicated by the brown colour of the anterior portion of the test. × 20.

Fig. 14.—Secretionary covering of the second-stage female. × 25.

Fig. 15.—Marginal fringe of the same, highly magnified.

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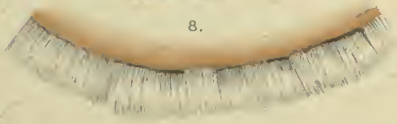
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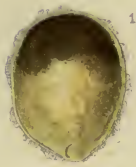
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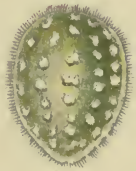
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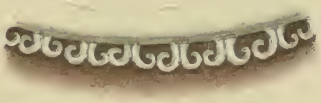
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# PLATE LXII.

## EXPLANATION OF PLATE LXII.

### Asterolecanium variolosum. (Page 156.)

Fig. 1.—Adult female after treatment with potash (ventral). × 35.
Fig. 2.—Abdominal extremity of the adult female. × 140.
Figs. 3, 3*a*.—Marginal compound or figure-of-8 spinnerets of adult female. × 600.
Fig. 4.—Dorsal tubular spinnerets of adult female. × 600.
Fig. 4*a*.—Dorsal compound figure-of-8 spinnerets. × 600.
Fig. 5.—Anal orifice of adult female. × 600.
Fig. 5*a*.—Rudimentary antenna of adult female. × 600.

### Asterolecanium bambusæ. (Page 151.)

Fig. 6.—Adult female after treatment with potash (ventral). × 20.
Fig. 7.—Anal extremity of adult female with anal lobes and anal orifice. × 140.
Fig. 8.—Marginal spinnerets of adult female. × 600.
Fig. 9.—Rudimentary antenna of adult female. × 600.
Fig. 10.—Rostrum of adult female. × 140.
Fig. 11.—Larva after treatment with potash. × 100.
Fig. 12.—Antenna of the embryo larva. × 300.
Fig. 13.—Leg of the embryo larva. × 300.
Fig. 14.—Leg of the second-stage larva. × 300.
Fig. 15.—Antenna of the second-stage larva. × 300.

### Asterolecanium thesii. (Page 154.)

Fig. 16.—Adult female after treatment with potash (ventral). × 25.
Fig. 17.—Abdominal extremity of adult female. × 140.
Fig. 18.—Dorsal compound figure-of-8 spinnerets. × 600.

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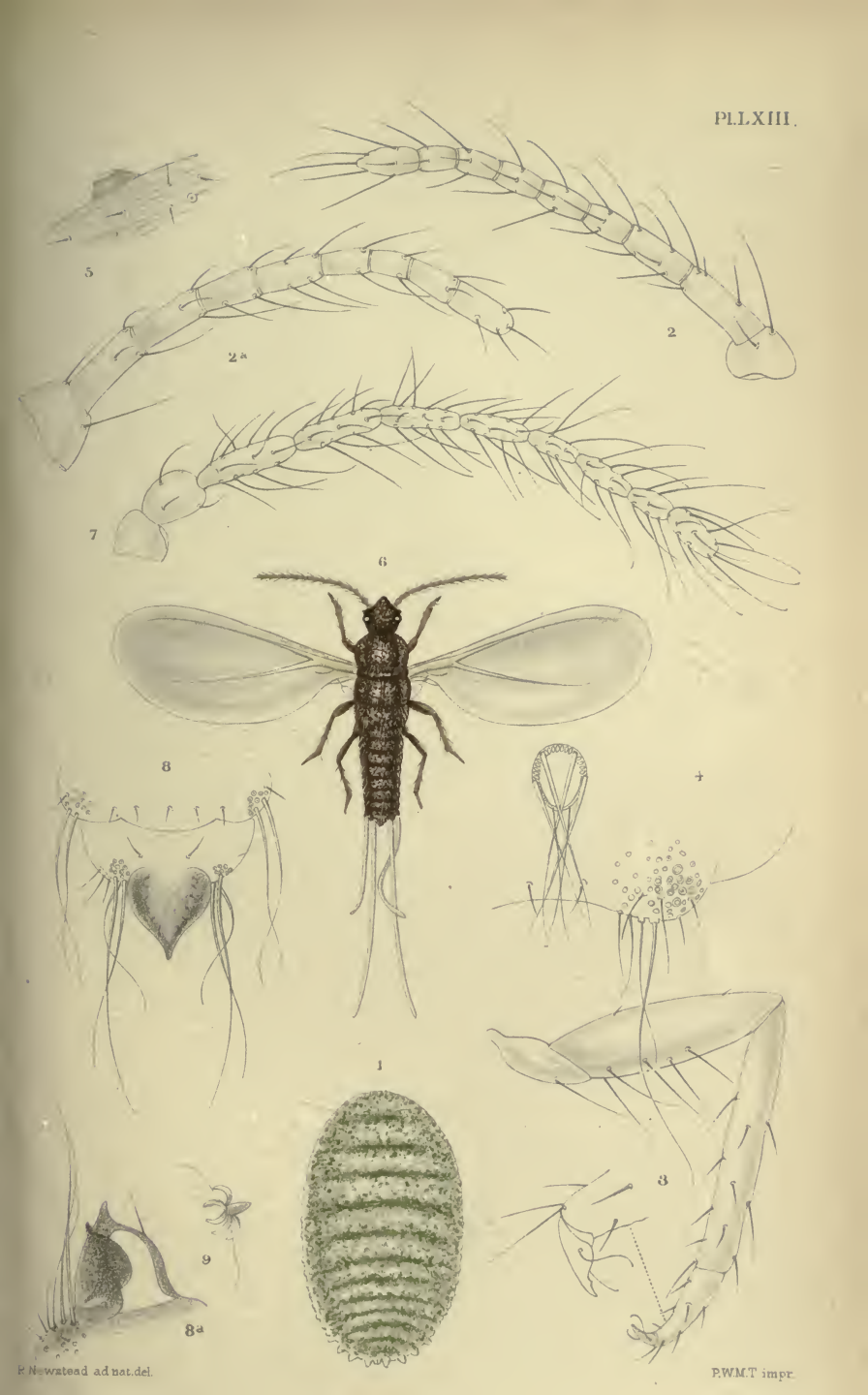
F.W.N. Fraipont

# PLATE LXIII.

## EXPLANATION OF PLATE LXIII.

PSEUDOCOCCUS ACERIS. (Page 176.)

Fig. 1.—Adult female at period of gestation (dorsal). × 10.
Figs. 2, 2*a*.—Antennæ of adult female. × 140.
Fig. 3.—Leg of the adult female. × 140.
Fig. 4.—Anal lobe and anal orifice of the adult female. × 140.
Fig. 5.—Eye of the adult female. × 140.
Fig. 6.—Male. × 25.
Fig. 7.—Antenna of the male. × 140.
Fig. 8.—Genital armature of the male (dorsal). × 140.
Fig. 8*a*.—The same (semi-profile). × 140.
Fig. 9.—Marginal spine of the larva, with waxen plates radiating from the base. Highly magnified.

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# PLATE LXIV.

## EXPLANATION OF PLATE LXIV.

### Dactylopius citri. (Page 164.)

Fig. 1.—Adult female (dorsal). × 15.
Fig. 2.—Antennæ of adult female. × 150.
Fig. 3.—Anal lobe and anal orifice of adult female. × 150.
Fig. 4.—Mentum of adult female. × 150.
Fig. 6.—Group of spinnerets and spines on abdominal segment of adult female. × 150.
Fig. 7.—Male. × 25.
Fig. 8.—Anal segment of male with genital armature and long setæ which support the filaments. × 150.
Fig. 9.—Antennæ of the male. × 150.
Fig. 10.—Pupa, first stage. × 30.
Fig. 11.—Pupa, final stage. × 25.

### Dactylopius longispinus. (Page 167.)

Fig. 12.—Adult female (dorsal). × 15.
Fig. 13.—Antennæ of adult female. × 150.
Fig. 14.—Marginal group of spinnerets and spines on abdominal segment of adult female. × 150.
Fig. 15.—Anal lobe and anal orifice of adult female. × 150.

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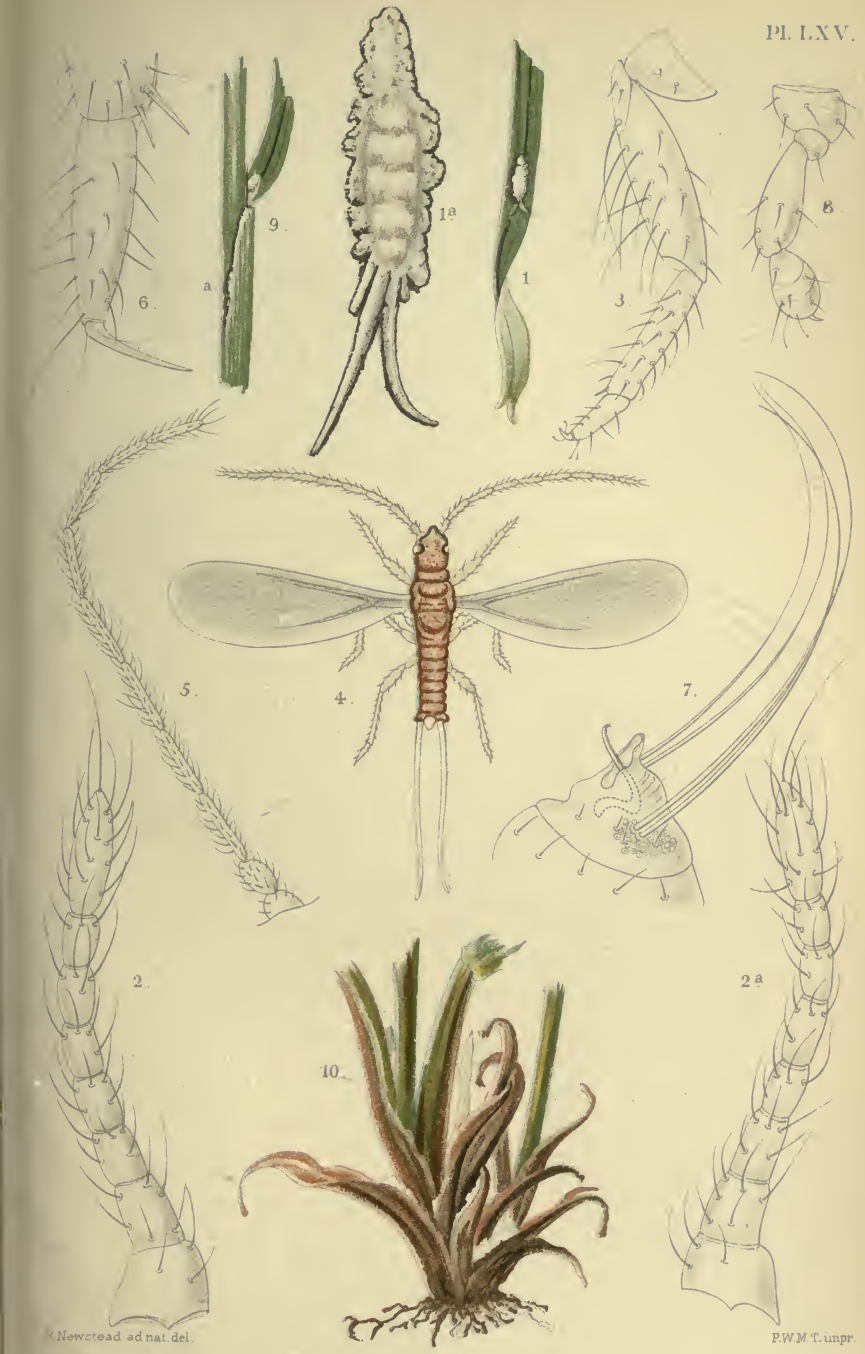
# PLATE LXV.

## EXPLANATION OF PLATE LXV.

DACTYLOPIUS WALKERI. (Page 169.)

Fig. 1.—Female natural size *in situ* on grass leaf.
Fig. 1*a*.—Adult female at period of gestation (dorsal). × 10.
Figs. 2, 2*a*.—Antennæ of adult female. × 150.
Fig. 3.—Malformed intermediate leg of male. × 150.
Fig. 4.—Male. × 25.
Fig. 5.—Antenna of male. × 75.
Fig. 6.—Tarsus and claw of male. × 150.
Fig. 7.—Genital armature of male and anal setæ (profile). × 150.
Fig. 8.—Leg of the adult female. × 75.
Fig. 9*a*.—Position of male puparium and male under leaf-sheath. Natural size.
Fig. 10.—Ovisacs in crown of grass plant. Natural size.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# PLATE LXVI.

## EXPLANATION OF PLATE LXVI.

### Dactylopius citri. (Page 164.)

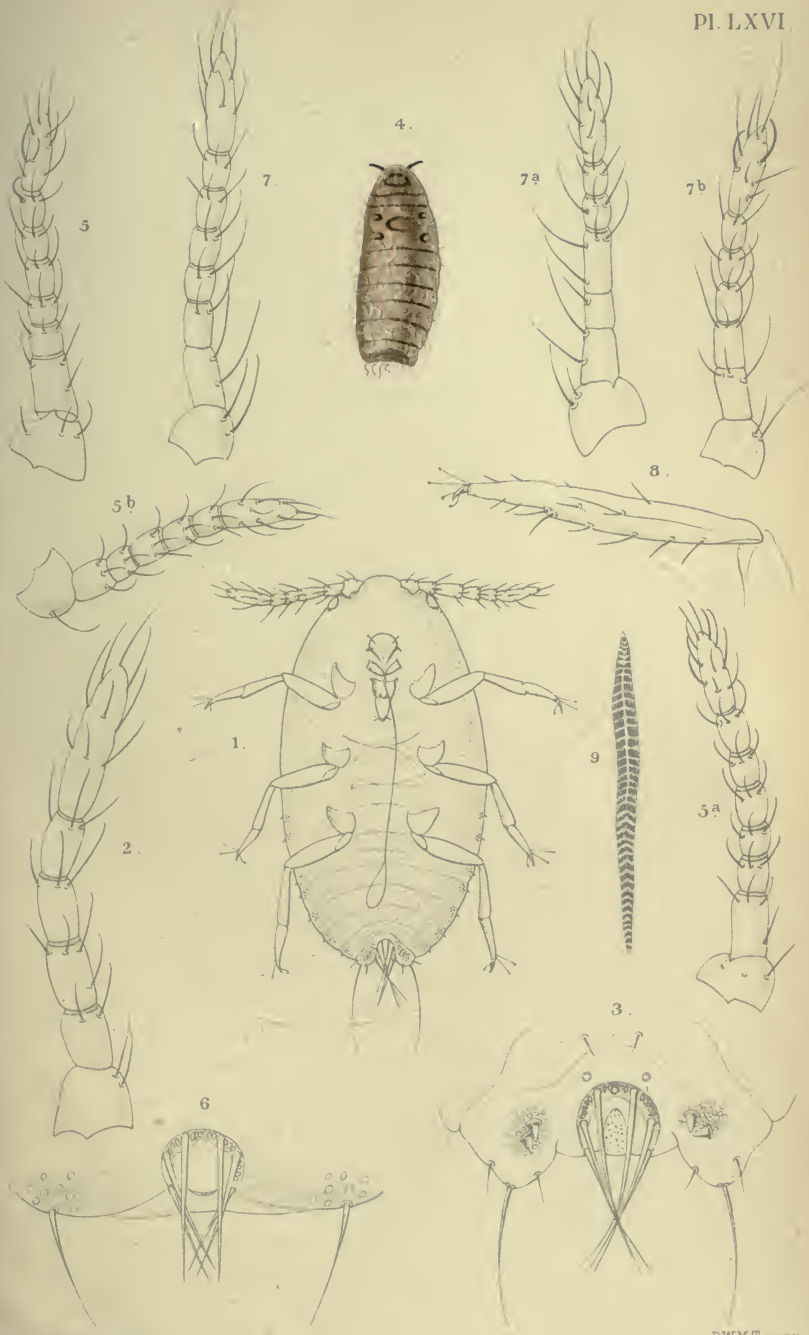
Fig. 1.—Larva after treatment with potash (ventral). × 100.
Fig. 2.—Antenna of larva. × 250.
Fig. 3.—Anal segment of larva, showing the somewhat prominent character of the anal lobes. × 250.

### Dactylopius pulverarius. (Page 174.)

Fig. 4.—Adult female (dorsal) from life. × 10.
Figs. 5, 5 *a*, 5 *b*.—Antennæ of adult female. × 150.
Fig. 6.—Anal segment of adult female, with lobes and anal orifice. × 150.

### Dactylopius hibernicus. (Page 172.)

Figs. 7, 7 *a*, 7 *b*.—Antennæ of adult female. × 150.
Fig. 8.—Tibia and tarsus of adult female. × 150.
Fig. 9.—Squamose structure on articulation of abdominal segments of adult female. × 250.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# PLATE LXVII.

## EXPLANATION OF PLATE LXVII.

RIPERSIA FILICICOLA. (Page 184.)

Fig. 1.—Adult female with cephalic extremity partly hidden beneath the brown epidermal scales of the fern, *Trichomanes spicatum*, and with the glassy filaments at the sides, which are secreted before the formation of the ovisac. × 15.

Fig. 2.—Adult female after treatment with potash (ventral). × 20.

Figs. 3, 3 *a*.—Antennæ of adult female. × 250.

Fig. 4.—Anal extremity of adult female (ventral). × 140.

Fig. 4 *a*.—Anal lobe of adult female (dorsal). × 140.

Fig. 5.—Dermis at cephalic extremity. × 250.

Fig. 6.—Mentum of adult female. × 140.

Fig. 7.—Tarsus of adult female. × 250.

Fig. 8.—Spiracle of adult female. × 250.

Fig. 9.—Early stage of the ovisac of the adult female with portions removed, revealing the female within. × 120.

Fig. 10.—Pupa (? second stage). × *circa* 40.

Fig. 11.—Puparium of male. × *circa* 30.

Fig. 12.—Insects (ovisacs and puparia) natural size *in situ* on frond of *Trichomanes spicatum*.

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# PLATE LXVIII.

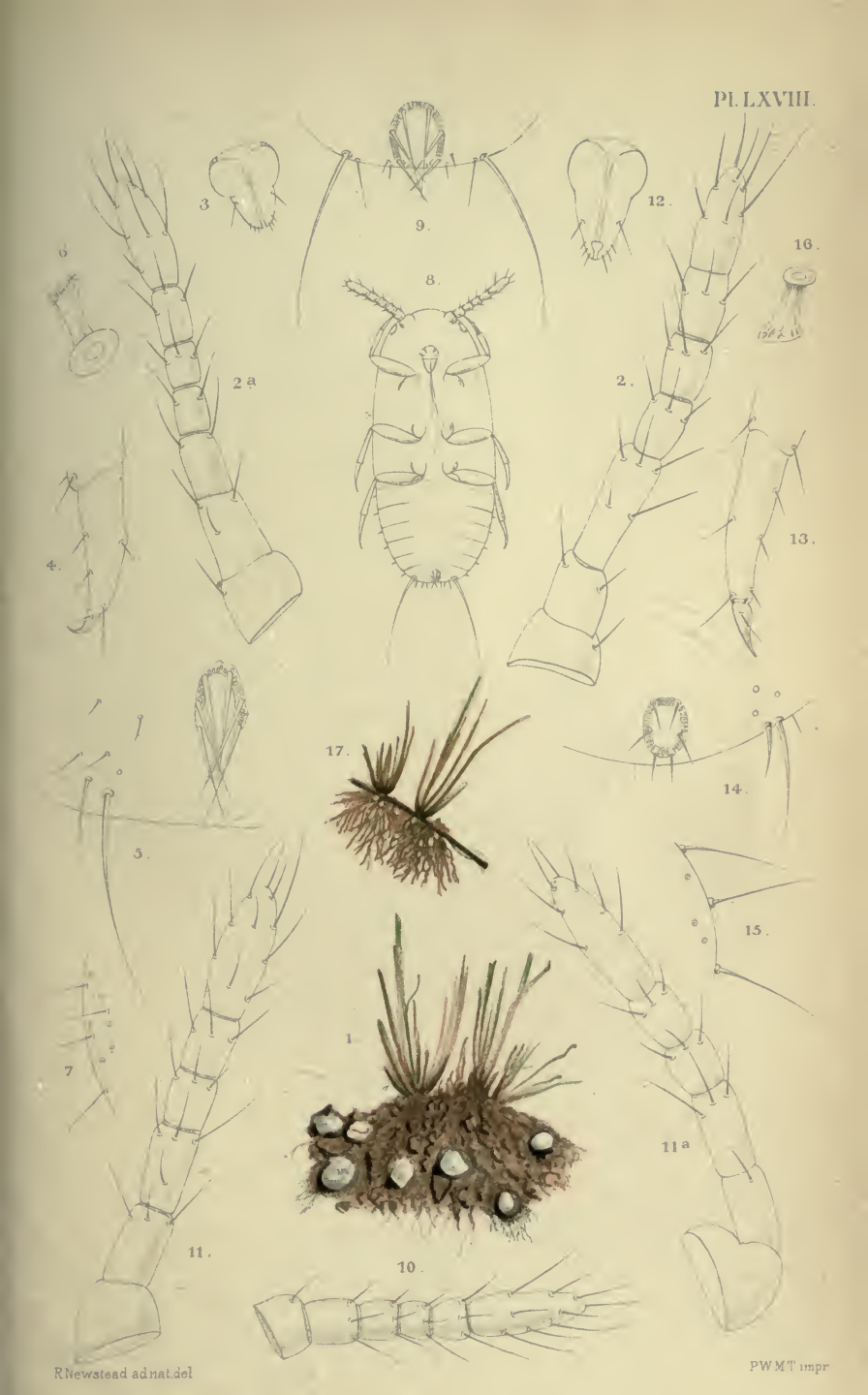
## EXPLANATION OF PLATE LXVIII.

### Ripersia tomlinii. (Page 186.)

Fig. 1.—Ovisacs of the female, natural size.
Figs. 2, 2*a*.—Antennæ of adult female. × 250.
Fig. 3.—Mentum of adult female. × 250.
Fig. 4.—Tarsus of adult female. × 250.
Fig. 5.—Abdominal lobe and anal orifice of adult female. × 250.
Fig. 6.—Spiracle of adult female. × 250.
Fig. 7.—Dermis, at cephalic margin, of adult female. × 250.
Fig. 8.—Larva (ventral). × 80.
Fig. 9.—Anal extremity of larva. × 250.
Fig. 10.—Antenna of the larva. × 250.

### Ripersia subterranea. (Page 189.)

Figs. 11, 11*a*.—Antennæ of adult female. × 250.
Fig. 12.—Mentum of adult female. × 250.
Fig. 13.—Tarsus of adult female. × 250.
Fig. 14.—Anal orifice and lobe of the adult female. × 250.
Fig. 15.—Marginal hairs, on dorsum between antennæ, of adult female. × 250.
Fig. 16.—Spiracle of adult female. × 250.
Fig. 17.—White secretion of the adult females on roots of grass from ant's nest. Natural size.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# PLATE LXIX.

## EXPLANATION OF PLATE LXIX.

### Ripersia terrestris. (Page 190.)

Fig. 1.—Insects and ovisacs natural size *in situ* on roots of *Adiantum*.
Fig. 2.—Adult female after treatment with potash (ventral). × 35.
Fig. 3.—Adult female after treatment with potash (dorsal). × 35.
Fig. 4.—Adult females from life (dorsal). × 10.
Figs. 5, 5*a*.—Antennæ of adult female. × 250.
Fig. 6.—Leg of the adult female. × 250.
Fig. 7.—Ova with part of ovisac removed. × 25.

### Ripersia halophila. (Page 192.)

Figs. 8, 8*a*.—Antennæ of adult female. × 250.
Fig. 9.—Leg of the adult female. × 250.

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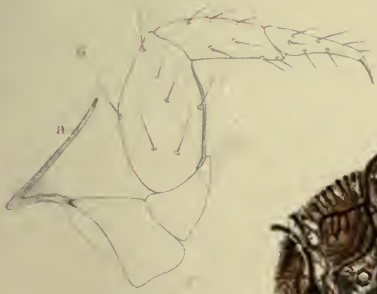

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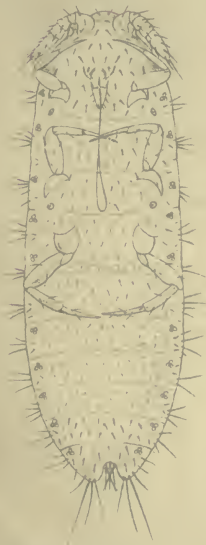

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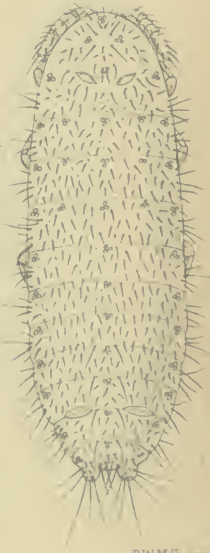

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# PLATE LXX.

## EXPLANATION OF PLATE LXX.

CRYPTOCOCCUS FAGI. (Page 215.)

Fig. 1.—Adult female (dorsal). × 40.
Fig. 1 *a*.—Adult female (ventral). × 40.
Fig. 1 *b*.—Adult female in the act of extruding an egg (semi-profile). × 40.
Figs. 2, 2 *a*.—Rudimentary antennæ of adult female. × 600.
Figs. 3, 3 *a*.—Rudimentary posterior legs of adult female. × 600.
Fig. 4.—Anal orifice of adult female. × 600.
Fig. 5.—Spiracle and parastigmatic glands of adult female. × 600.
Fig. 6.—Ovisacs of insects natural size *in situ* on portion of beech bark; young colony with ovisacs more or less isolated.
Fig. 6 *a*.—An older colony representing many generations with the ovisacs crowded together and overlying each other. Natural size, in profile.
Fig. 6 *b*.—A few more or less isolated ovisacs *in situ*. × 4.
Fig. 6 *c*.—Upper portion of ovisacs removed, revealing a number of females and eggs and a species of Thrips, which was found *beneath* the woolly covering. × 4.
Fig. 7.—Larva after treatment with potash. × 150.
Fig. 8.—Antenna of the larva. × 300.
Fig. 9.—Leg of the larva. × 300.
Fig. 10.—Anal extremity of abdomen of larva. × 250.

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# PLATE LXXI.

## EXPLANATION OF PLATE LXXI.

### Eriococcus insignis. (Page 198.)

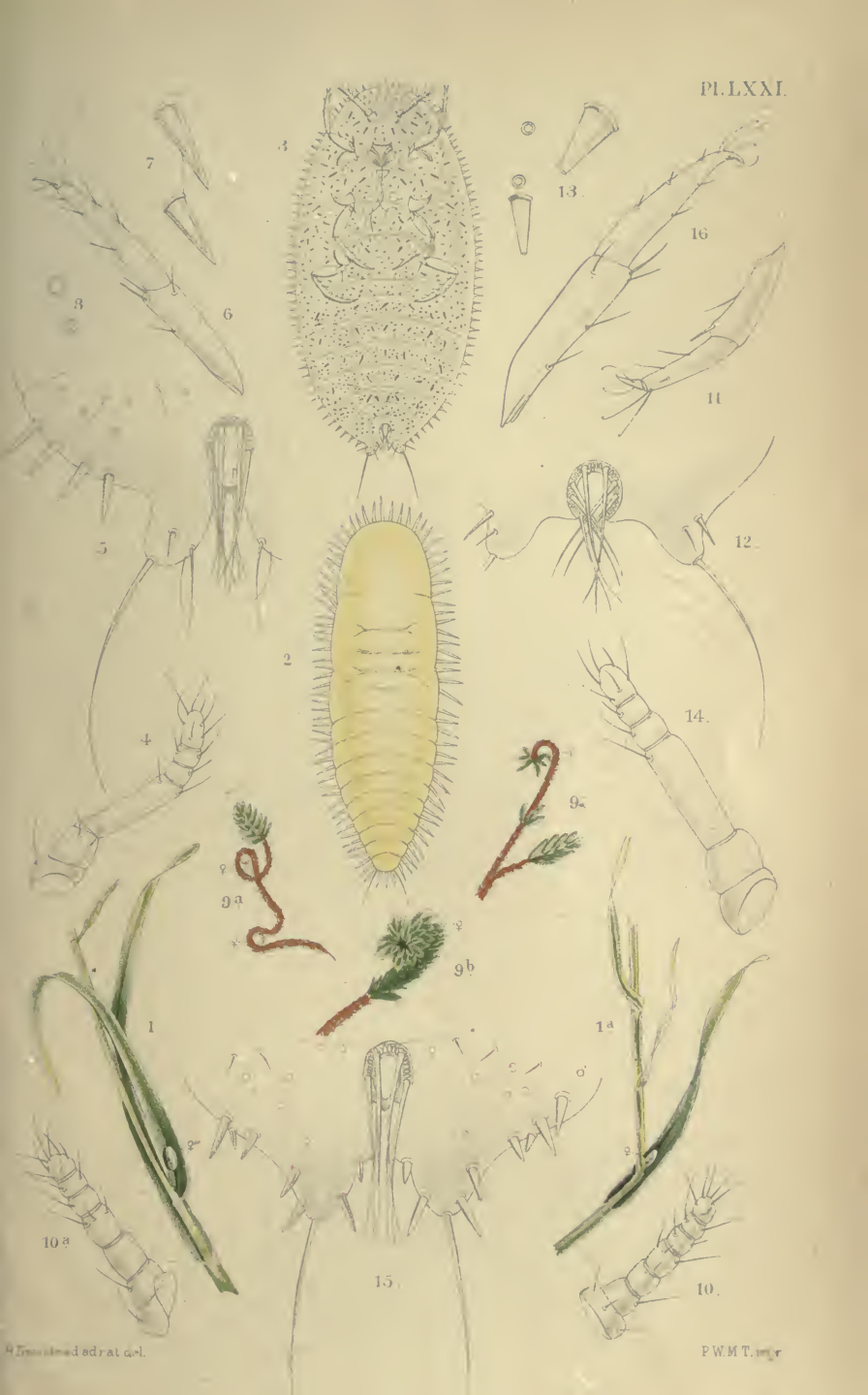
Figs. 1, 1 *a* (marked ♀).—Ovisacs of female natural size *in situ* on grass leaves.
Fig. 2.—Female, second stage, from life (dorsal). × 40.
Fig. 3.—Adult female after treatment with potash (ventral). × 25.
Fig. 4.—Antenna of adult female. × 150.
Fig. 5.—Anal segment of adult female (part), with anal lobe and anal orifice. × 150.
Fig. 6.—Tarsus and claw of adult female. × 150.
Fig. 7.—Marginal secreting spines of adult female. × 300.
Fig. 8.—Dorsal spinnerets. × 300.

### Eriococcus devoniensis. (Page 201.)

Figs. 9–9 *b* (marked ♀).—Ovisacs of female natural size *in situ* on twigs of heath contorted by the insects; at 9 and 9 *a* the leaves have been removed in order to reveal the ovisacs; at 9 *b* the rosette of leaves, produced by the female, has not been removed, and the position of the ovisac is indicated by the ♀.
Figs. 10, 10 *a*.—Antennæ of adult female. × 150.
Fig. 11.—Tarsus and claw of adult female. × 150.
Fig. 12.—Anal segment of adult female, with lobes and anal orifice. × 150.
Fig. 13.—Spines and spinnerets of adult female. × 300.

### Eriococcus greeni. (Page 200.)

Fig. 14.—Antenna of adult female. × 150.
Fig. 15.—Anal segment of adult female with anal lobes and anal orifice. × 150.
Fig. 16.—Tarsus and claw of adult female. × 150.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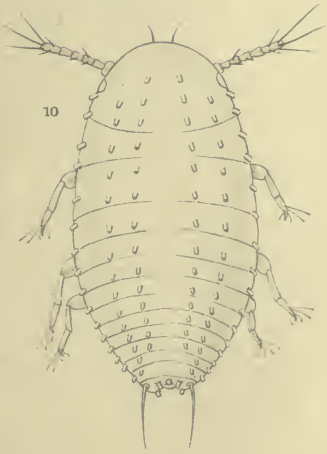
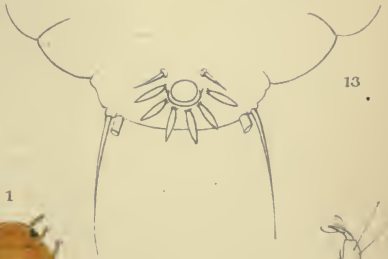
# PLATE LXXII.

## EXPLANATION OF PLATE LXXII.

APTEROCOCCUS FRAXINI. (Page 210.)

Fig. 1.—Female, second stage, from life (dorsal). × 35.
Fig. 2.—Antennæ of adult female. × 300.
Fig. 3.—Leg of the adult female. × 300.
Fig. 4.—Anal extremity of adult female. × 600.
Fig. 5.—Dorsal tubular spinneret of adult female. × 600.
Fig. 5*a*.—Simple spinnerets of adult female. × 600.
Fig. 6.—Apterous male, from life (dorsal). × 35.
Fig. 7.—Antenna of the male. × 250.
Fig. 8.—Leg of the male. × 250.
Fig. 9.—Genital armature of male (profile). × 250.
Fig. 9*a*.—The same (ventral). × 250.
Fig. 10.—Larva (dorsal). × 150.
Fig. 11.—Antenna of the larva. × 600.
Fig. 12.—Leg of the larva. × 600.
Fig. 13.—Anal extremity of the larva. × 600.
Fig. 14.—Pupa, from life (ventral). × 35.





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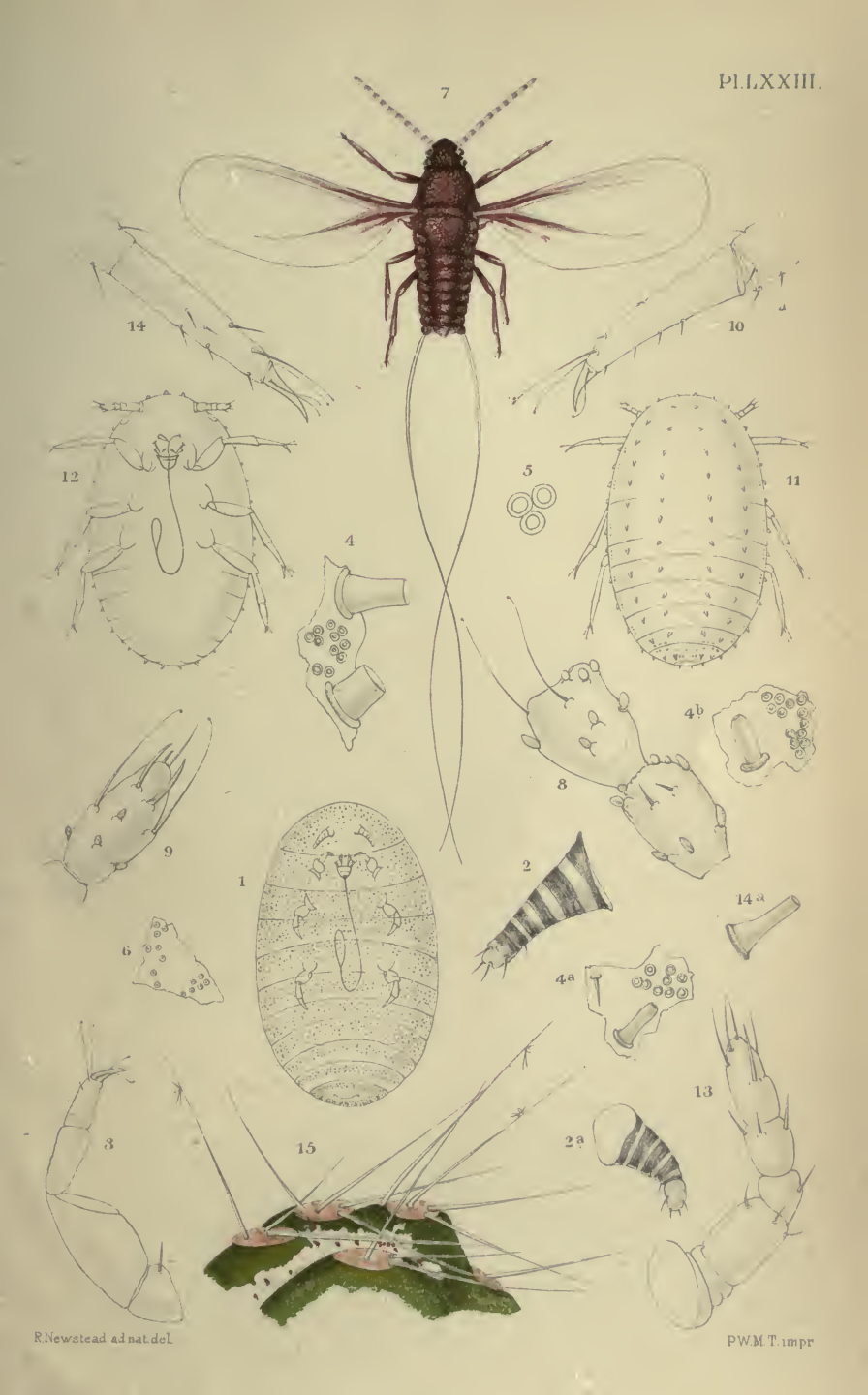
# PLATE LXXIII.

## EXPLANATION OF PLATE LXXIII.

COCCUS TOMENTOSUS. (Page 223.)

Fig. 1.—Adult female, as seen by transmitted light after treatment with potash, showing bands of truncate spines on dorsal surface. × 15.
Figs. 2, 2 *a*.—Antennæ of adult female. × 140.
Fig. 3.—Leg of adult female (*minus* the broad coxa). × 140.
Figs. 4, 4 *a*, 4 *b*.—Portions of dorsal dermis with truncate spines and grouped spinnerets. × 300.
Fig. 5.—Dorsal grouped spinnerets. × 600.
Fig. 6.—Ventral dermis with small spinnerets. × 300.
Fig. 7.—Male. × 35.
Fig. 8.—Fourth and fifth joints of male antenna. × 140.
Fig. 9.—Apical joint of male antenna. × 140.
Fig. 10.—Anterior tarsus of male. × 140.
Fig. 11.—Larva (dorsal). × 150.
Fig. 12.—Larva (ventral). × 150.
Fig. 13.—Antenna of larva. × 300.
Fig. 14.—Tarsus of larva. × 300.
Fig. 14 *a*.—Dorsal spine of larva. × 600.
Fig. 15.—Insects (male and female) natural size *in situ* on portion of food-plant.

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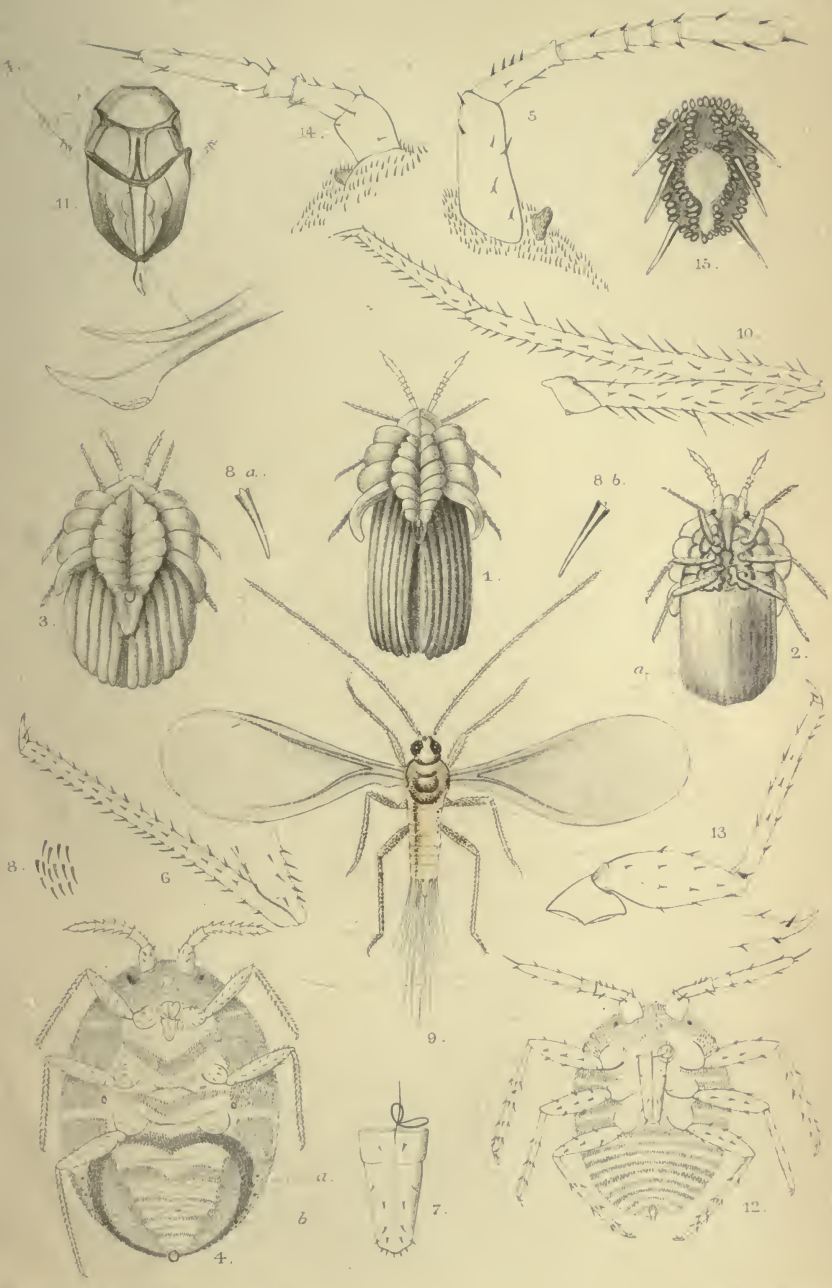
# PLATE LXXIV.

## EXPLANATION OF PLATE LXXIV.

NEWSTEADIA FLOCCOSA. (Page 242.)

Fig. 1.—Old adult female with fully developed marsupium (dorsal). × 7.
Fig. 2.—Young adult female with the marsupium (*a*) about two-thirds developed (ventral). × 7.
Fig. 3.—Dorsal view of a similar specimen. × 7.
Fig. 4.—Adult female after treatment with potash: *a*, marginal gland-tract; *b*, marsupial gland-tract. × 25.
Fig. 5.—Antenna of the adult female. × 70.
Fig. 6.—Tibio-tarsal joint of the adult female. × 70.
Fig. 7.—Mentum of the adult female. × 70.
Fig. 8.—Group of glandiferous spines of the adult female. × 150.
Figs. 8 *a*, 8 *b*.—Glandiferous spines more highly magnified. × 600.
Fig. 9.—Male. × 35.
Fig. 10.—Leg of the male. × 70.
Fig. 11.—Genitalia of the male. × 70.
Fig. 12.—Larva after treatment with potash (ventral). × 70.
Fig. 13.—Leg of the larva. × 140.
Fig. 14.—Antenna of the larva. × 140.
Fig. 15.—Anal orifice of the larva. × 600.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# PLATE LXXV.

## EXPLANATION OF PLATE LXXV.

### Orthezia urticæ. (Page 230.)

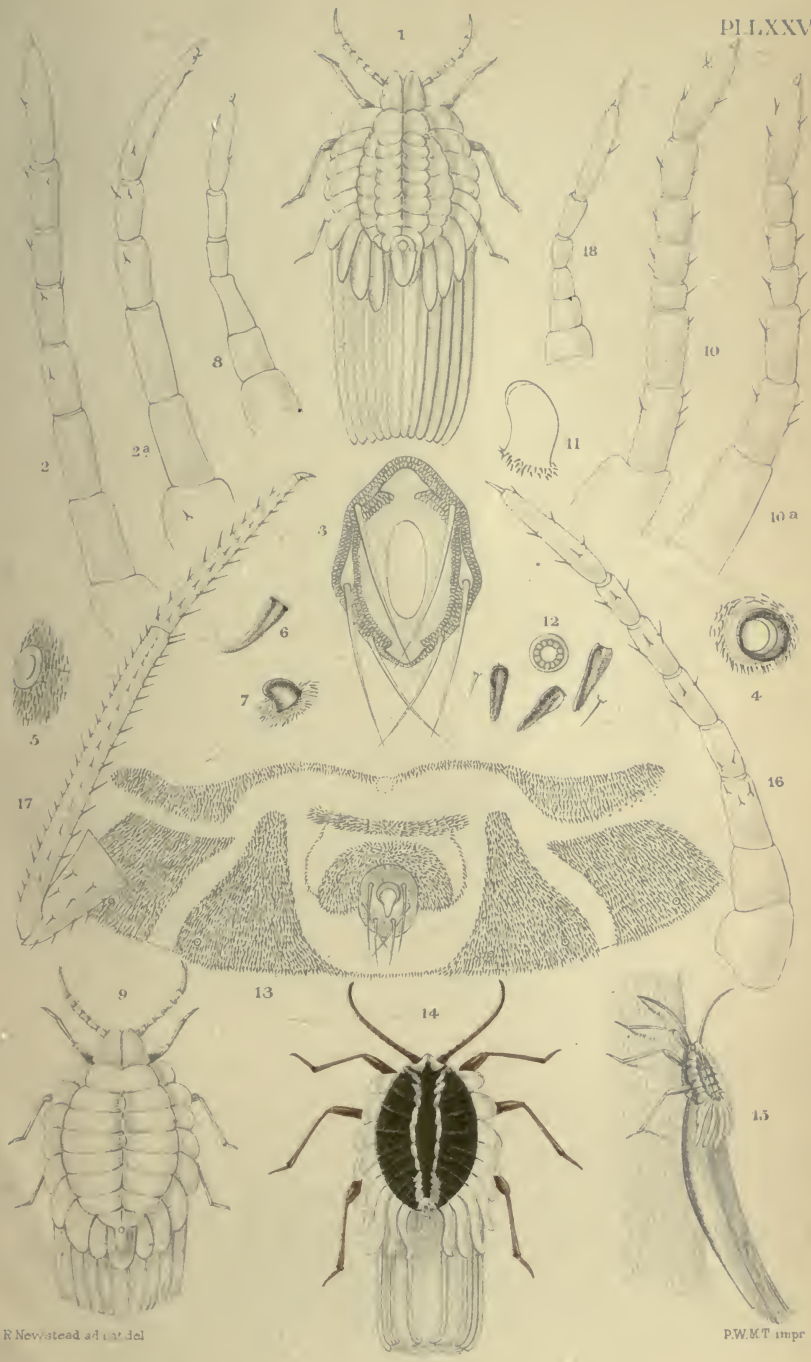
Fig. 1.—Adult female (dorsal). × 7.
Figs. 2, 2*a*.—Antennæ of adult female, from the same individual; fig. 2 represents a typical antenna, fig. 2*a* an abnormal one. × 75.
Fig. 3.—Anal orifice of the adult female. × 150.
Fig. 4.—Ventral spiracle of the adult female. × 150.
Fig. 5.—Abdominal spiracle of adult female. × 250.
Fig. 6.—Glandiferous spine of adult female from gland-tract. × 600.
Fig. 7.—Eye of the adult female. × 75.
Fig. 8.—Antenna of the larva. × 150.

### Orthezia cataphracta. (Page 233.)

Fig. 9.—Adult female (dorsal). × 7.
Figs. 10, 10*a*.—Antennæ of the adult female; fig. 10 represents a typical antenna, fig. 10*a* an abnormal one. × 75.
Fig. 11.—Eye of the adult female. × 75.
Fig. 12.—Abdominal spiracle of the adult female, with three of the surrounding glandiferous spines and two fine hairs. × 600.
Fig. 13.—Terminal segment of the adult female, showing gland-tracts and anal orifice (dorsal). × 75.

### Orthezia insignis. (Page 236.)

Fig. 14.—Adult female with the marsupium partly developed. × 20.
Fig. 15.—Old adult female with the marsupium fully developed, and the young larvæ hatched therefrom. × 10.
Fig. 16.—Antenna of the adult female. × 75.
Fig. 17.—Tibia and tarsus of the adult female. × 75.
Fig. 18.—Antenna of the larva. × 75.

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